

# AMATEUR WORK



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# AMATEUR WORK,

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## ILLUSTRATED.

A PRACTICAL MAGAZINE OF  
CONSTRUCTIVE AND DECORATIVE ART AND MANUAL LABOUR.

*WITH SUPPLEMENTS,*

Containing Designs and Working Drawings to Scale, for  
Various Pieces of Work, Useful and Ornamental,

AND

SEVERAL HUNDRED ILLUSTRATIONS.

VOLUME II.—NEW SERIES.

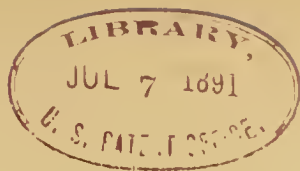
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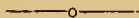


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AMERICAN ORGAN, COMPLETE.



# AMATEUR WORK, ILLUSTRATED.

## THE "A. W." WINDOW EASEL.

By A. SAVIL.

**A**N easel which is always ready for use, takes up no room, and which also does duty as a writing or reading desk, and window-screen, will, I expect, be useful

one at which I now stand, and which is of the simplest construction ; but as there is "nothing new under the sun," it may be no novelty. On the other hand, in offering the following sug-

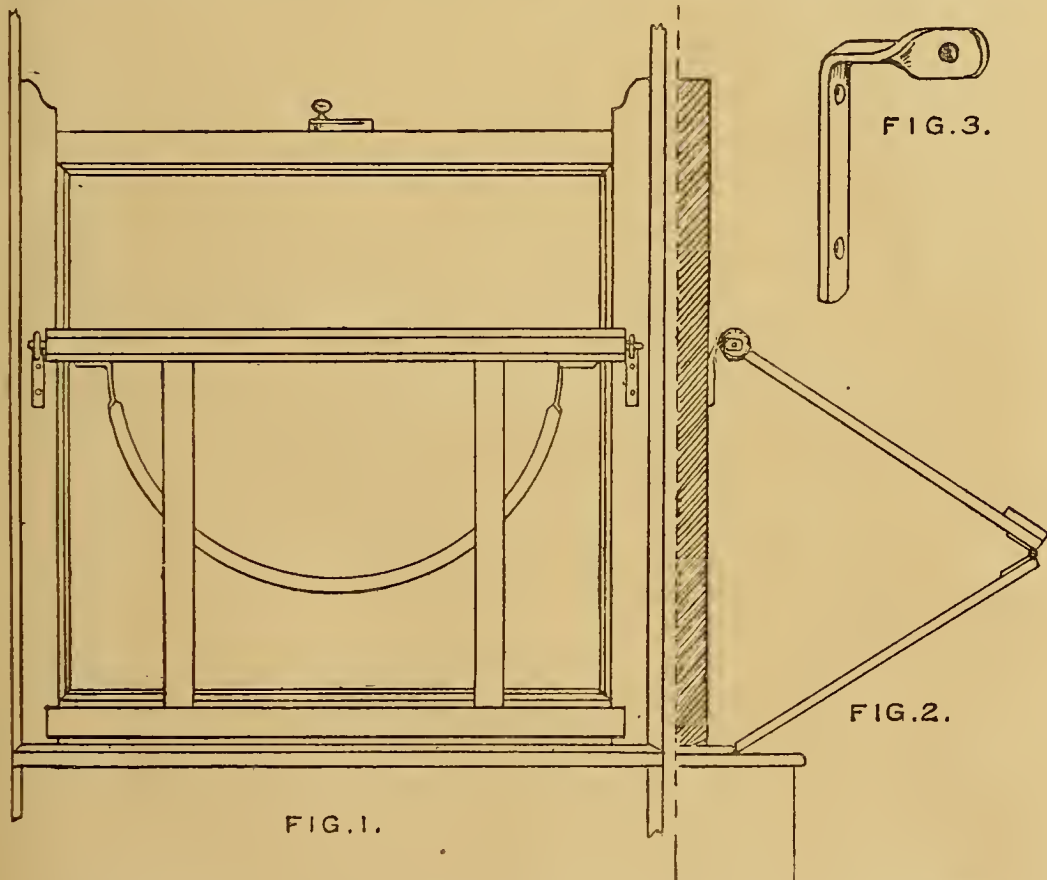


FIG. 1.—EASEL ATTACHED TO SASH FRAME. FIG. 2.—SIDE VIEW OF EASEL, OPEN. FIG. 3.—BRACKET FOR ATTACHING EASEL TO SASH.

to many who prefer to stand while drawing or writing, and to others to whom economy of space is a consideration.

I have never seen such an article, except the Vol. II. (New Series).—Part 13.

gestions, I may be forfeiting an opportunity of becoming famous by taking out a patent! If, however, anyone takes my hint, let this page be witness that "A. W." is the "father of the

thought." Fig. 1 represents the easel in its simplest form, laying no claim to beauty, but only utility.

The framework consists of four pieces of wood and one stay of flat iron  $\frac{7}{16}$  inch by  $\frac{3}{8}$  inch. It is supported by two folding legs, hinged to the lower edge, which, when in use, rest upon the window sill (Fig. 2), and, when not in use, are folded between the easel and the sash.

The mountings consist of two small pivots or "spuds," as used for old-fashioned window-blind rollers, which work in two small brackets made of flat iron.

As these brackets are attached to the sash, the whole "arrangement" moves with it, and so the easel does not interfere with the opening and shutting of the window.

The wood employed may be of any light description—white deal, pine, mahogany, etc. I used the first-named, and find it answers well.

For the upper rail of the easel, which is the foundation of the whole, cut a piece of timber  $1\frac{1}{4}$  inches square, and long enough to reach from about the centre of the sides of the sash on each side; plane up true, and convert into an octagon by removing the corners.

Next cut two pieces—say, 2 feet long,  $1\frac{1}{2}$  inches by  $\frac{3}{4}$  inch. These are to be mortised into the upper rail at points about 8 inches from each end, and serve to support a drawing-board; but if it is required for a small board, or in case the window sash is of extra width, there may be three of these upright pieces.

The lower rail may consist merely of a batten of the same scantling as the uprights, and of the same length as the upper rail, simply nailed or screwed to the uprights to form a rest for the edge of the drawing-board, etc. If, however, the uprights are mortised in the lower rail, and a slip be secured to the edge, projecting about  $\frac{3}{4}$  inch, as a support for the board, a better job will be made. We now have the frame of the easel complete, as far as the woodwork is concerned, but being so lightly constructed, it would not stand much use in its present state, so we must provide for rigidity as well as lightness.

This object is attained by means of the iron stay before mentioned, and which is shown at Fig. 1. My easel is 38 inches wide, and the stay took 56 inches of iron; but the length required will, of course, vary with the size of the window.

If carefully handled, the iron may be bent while cold, and if the appliances mentioned in my papers on "Metal Scrollwork," pp. 342 and 349, Vol. I., are used, no difficulty will be encountered.

Cut the required length of iron, and at points 6 inches from each end twist the iron one half turn, and then using a small scroll-wrench fixed in a vice, bend the iron into shape, as indicated in the drawing (Fig. 1). Drill and countersink screw holes, by which to attach the stay to the upper rail and uprights, and fix it in position upon the underside of the easel, which will now be found to have become quite rigid, and therefore strong.

The legs are simply formed of  $1\frac{1}{2}$  inch by  $\frac{3}{4}$  inch stuff, the length depending upon the depth of the easel, so that when not in use the legs may fold up between the frame and the window sash. The legs are attached to the frame by a pair of brass butt hinges (see Fig. 2).

For mounting, I used pivots made from a pair of old window-blind rollers, cutting away the outer part, and leaving only the centre with "spud" and three screw holes.

The brackets are made of ribbon iron, the same as used for the stay, and each bracket consists of a piece 5 inches long.

Twist the iron 1 inch from the end, and drill a hole for the pivot; bend 2 inches from the end, and drill two screw holes in the longer arm, by which to attach the bracket to the sash (see sketch, Fig. 3).

Two or three coats of Aspinall's Enamel will make the easel quite respectable, if not beautiful, and the artistic reader who follows these directions will possess a most useful adjunct to his *den*.

If the principle of mounting, etc., described above, be applied to a more elaborate frame, covered with "art fabric," wire gauze, or perforated zinc, the easel will also serve as window-screen.

## A MECHANICAL SAVINGS BANK.

By THE MOCK TURTLE.



N the old series of AMATEUR WORK several directions were given for the construction of Models on the "drop a penny in the slot" system, intended for the purpose of extracting coin from the pockets of unwary visitors to that very money-making institution, the bazaar, or for the more laudable object of inducing the little ones to "take care of the pence," by giving them some immediate return for the deposit, in the form of amusement—a sort of *quid pro quo*. These were all on the old system of moving models; a windmill with revolving sails, a ship rocking on the waves, etc.; but the one I am about to describe is somewhat different, inasmuch as it is not so much a model as an exhibition of pictures, which may be varied indefinitely without alteration to the mechanism of the "Bank." It is also somewhat easier to make than the ordinary "moving model," the mechanical part, or motive power—the works of a cheap American timepiece—requiring very little alteration to adapt it to present requirements. One of these timepieces can be bought for half-a-crown. As a matter of fact the one I purchased was priced in the dealer's window at 2s. 5½d., I presume for the reason that the fractional amount *sounds* less than half-a-crown, though it struck me with great force, when receiving the change out of that coin of the realm, that the actual difference was not great. This timepiece, after doing its legitimate duty of marking time for twelve months, in a very spirited and satisfactory manner, suddenly broke down, and utterly declined to resume work. After lying by for a time amongst sundry lumber, it was relegated to the humbler duty of acting as driving power to my mechanical bank, a sphere of duty which appears to suit its constitution better than the more delicate operation of time keeping.

As this piece of mechanism forms the chief item of expense in the construction of the bank, it cannot be considered a very costly toy. Before describing the alteration necessary to convert the timepiece into a driving engine, it

will perhaps be better to briefly refer to the box which is to contain it, and which forms the bank. Of course, it is not necessary to the proper working of the machine, that it should be covered in, but as familiarity with the very simple means used to produce the result exhibited, might produce the usual effect on the youthful mind—for does not the proverb say "familiarity breeds contempt"—it is very desirable that it should not be exposed to view.

The box (shown in Fig. 1) is made of thin wood,  $\frac{1}{2}$  inch being quite thick enough, and should preferably be dovetailed together, as that is the more workmanlike method of construction, but thin wire nails will answer the purpose if you are inclined to shirk the dovetailing. Please note, however, that I do not recommend the shirking process, for I like to see work properly done, though, may be, I don't always practise what I preach. The outside dimensions of the box are marked in the drawing; you will see that the bottom projects  $1\frac{1}{2}$  inches beyond the sides, and should have a narrow bead run on the front edge as a finish.

The back of the box is not all in one piece, because means must be provided for getting at the back of the mechanism, for the purpose of winding up the same when run down. Fig. 2 shows the back. The top and bottom pieces (the former 3 inches wide, and the latter 1 inch) are screwed on. Between these two a piece 9 inches wide is fitted as a door, being hinged to the bottom piece, and provided with a lock to lock into the top piece. It may, if preferred, be hinged at the side.

The front of the box, Fig. 4, consists of a piece of thin fretwood 10 inches wide by 14 inches high, that is, the same width as the box, but 1 inch higher. It should be hinged on to one side of the box, and provided with a lock or hook and eye, to keep it closed until such time as it is necessary to open it for the purpose of substituting a new disc. On this is pasted a picture, a suitable subject being an artist at work in his studio. If you cannot draw or paint this for yourself, you will no doubt be able to select a suitable one from some illustrated paper. The one I used was cut from an old





FIG. 9.—COIL OF  
COPPER WIRE TO  
FORM WEIGHT.

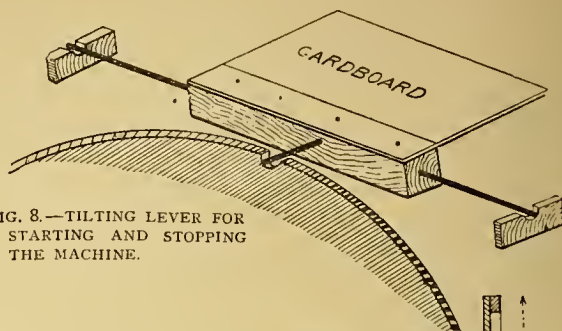


FIG. 8.—TILTING LEVER FOR  
STARTING AND STOPPING  
THE MACHINE.

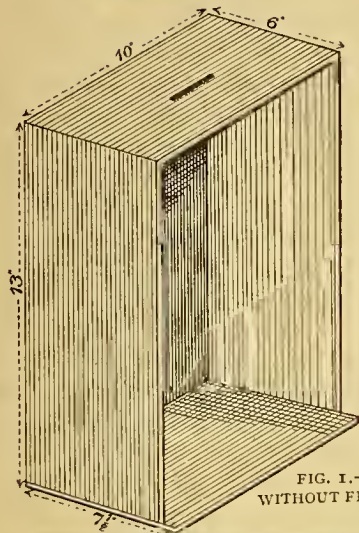


FIG. 1.—BOX  
WITHOUT FRONT.

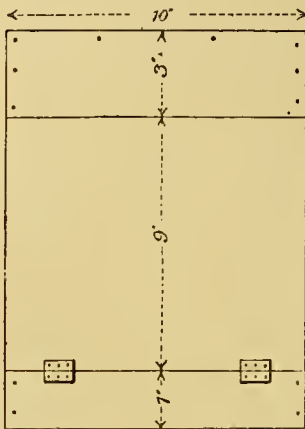


FIG. 2.—BACK OF BOX.

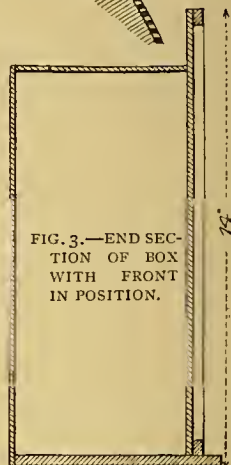


FIG. 3.—END SEC-  
TION OF BOX  
WITH FRONT  
IN POSITION.

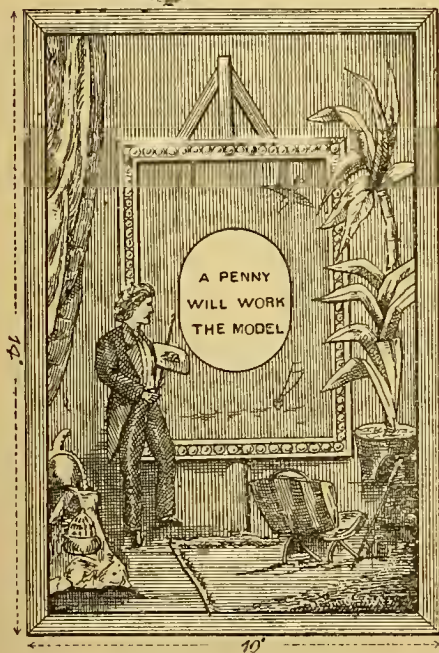


FIG. 4.—  
FRONT OF  
BANK.

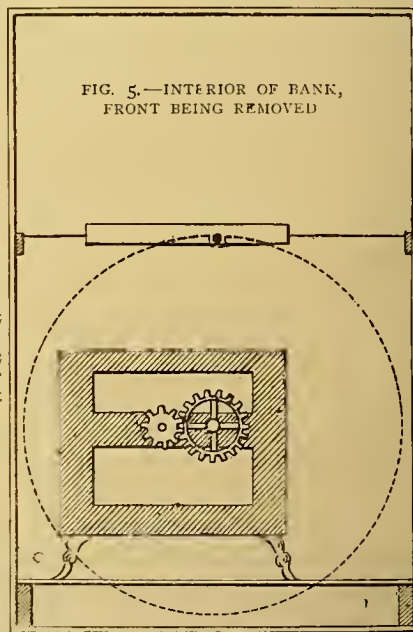


FIG. 5.—INTERIOR OF BANK,  
FRONT BEING REMOVED



FIG. 7.—SHOWING  
EXACT SIZE OF  
NOTCH IN EDGE  
OF DISC.



number of *The Sporting and Dramatic News*. With a fret-saw I cut out an oval  $2\frac{1}{4}$  inches high and  $1\frac{3}{4}$  inches wide, the top of the oval being 10 inches from the bottom of the box. It is through this oval that the pictures are exhibited, being pasted on a revolving disc, which brings them, one after another, in view through the opening, as will be presently described. On dropping a penny in the slot at the top of the box, the disc is caused to revolve, exhibiting the pictures placed round it while it makes one revolution. As the pictures are pasted on a cardboard disc which is attached to the wooden disc by means of pins, a fresh series of pictures can be exhibited at any time with very little trouble, by substituting a fresh cardboard.

The disc on which the pictures are exhibited is shown by dotted lines in Fig. 5, and consists of a circle,  $9\frac{1}{4}$  inches in diameter, cut from a piece of thin fret-wood. The wood used should be the kind known as "three-ply" fret-wood, so that it may not warp, otherwise the starting and stopping of the machine will not act with certainty.

In order to convert your timepiece into driving power for the model, take the works out of the case, and from the works take the escapement. The effect of this will be that when the timepiece is wound up, the hands will go round at a great rate and mark off the twenty-four hours at a pace that would astonish old Father Time if he had to keep up with it, and bring round our much-longed-for number of AMATEUR WORK at more satisfactory intervals.

Now take off the long hand; a little force will effect this. The hour hand will now come off with ease, and also the large cog-wheel which drives it. All that is now left outside the frame are two cog-wheels, as shown in Fig. 5, and it is the larger of these two that has to be attached to the disc. It is really two wheels in one, since it has a small cog-wheel attached which drove the hour hand wheel which was just now dispensed with. However, for our purpose it

may be considered one wheel, as the small cog-wheel attached is of no use but need not be removed; I doubt if you even could remove it. Procure a large cotton reel, one of the kind on which crochet cotton is sold, cut off one end and fix the rest of the reel on the cog-wheel, allowing the small cog-wheel to go inside the hole of the reel. The fixing may be done by putting on plenty of very thick glue and bedding the wheel in it, and further fixing it with pins of wire or some small screws, when it will appear as in Fig. 6.

Cut out the disc of fret-wood previously described and attach this reel to it, centrally, with glue. When dry, put the cog-wheel back into its original place, and as it is now attached to the disc, it follows that when the cog-wheel revolves the disc also revolves with it.

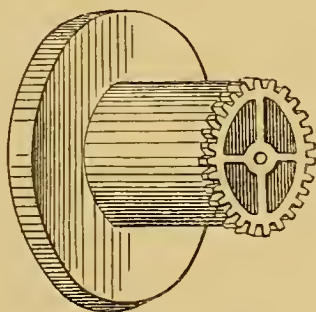


FIG. 6. — PART OF COTTON REEL HAVING COG-WHEEL ATTACHED.

Now fix the clockwork in place so that the disc revolves close behind the front of the box, but without touching it, and so that the edge of the disc is about  $\frac{1}{4}$  inch above the oval hole. It may be fixed to a shelf running across the box from side to side and resting on ledges, the fixing being easily accomplished by means of copper wire passing over the framework and through the shelf, and twisted tight with the pliers underneath.

Having provided for the revolution of the disc, we have now to consider how to start it with the intervention of the necessary penny, and to stop it when the disc has performed one revolution. I omitted to say just now that the disc should have a notch cut in the edge, as shown in Fig. 7. This is for a wire pin to drop into, which prevents the disc revolving until released.

A reference to Fig. 8 shows the starting and stopping arrangement, and this again is shown in position at *a*, Fig. 5. It consists of a rectangular piece of wood like one of the long bricks in a child's box of bricks. In each end of this a piece of stiff wire is inserted centrally, the total length of wood and wires being equal to the width of the box.

On each side of the box, at the height of the disc, a slip of wood is glued, having a notch for the wire to work in. In the front of the slip of wood a pin of stiff wire is fixed, just reaching to the notch in the disc. On this wire, and just behind the disc, a weight is hung to keep the wire in the notch. The weight may conveniently consist of a coil of copper wire, as in Fig. 9. On the top of the slip of wood a piece of cardboard is fastened with tacks. A slit is cut in the top of the box just over the cardboard, and when a penny is dropped through on to the cardboard, it tilts the wire out of the notch and allows the disc to revolve until the notch again comes round to the wire, when the weight causes it to drop into the notch again and so stops the machinery.

All that is required now is to provide the show. Cut a disc of cardboard a little smaller than the wooden disc so as not to cover the notch. Fix this cardboard to the wooden disc by means of drawing pins or small bent wires. Put the front of the bank in its place, and with a sharp pointed pencil mark the shape of the oval on to the cardboard. Allow the disc to revolve the width of the oval and again mark the shape as before. Repeat this until ovals have been marked close together all round the cardboard disc. On the first oval print the words, "A Penny will Work the Model," or words to that effect. On each of the other ovals paste pictures selected according to fancy. A comic selection is probably most appreciated; and one of the most side-splitting selections is to "annex" some of the contents of the family portrait album, and transpose the bodies and heads of your uncles and your cousins and your aunts, putting old heads on young shoulders and *vice versa*. The effect is extremely ludicrous; only, if you have a rich old uncle staying with you, and have made free with his body or head, carefully lock up that particular disc until his departure, or he may alter his will.

My "Bank" has amply repaid the trifling expense and trouble of making it; and if I have not made everything quite clear, please apply through "Amateurs in Council," when any further information required shall be given:

## AMERICAN ORGAN BUILDING.

By THOS. L. WINNETT.

I. — INTRODUCTION — PRINCIPLE OF CONSTRUCTION — DIFFERENCE BETWEEN HARMONIUM AND AMERICAN ORGAN — DESCRIPTION OF THE "REED" — COST — LIST OF MATERIALS REQUIRED — SPECIFICATION — WHERE TO BUY MATERIALS — MAKING THE BELLOWS AND RESERVOIR.

(For an Illustration of the Instrument complete, see Coloured Supplement issued with this Part.)

**I**N introducing this series of articles on the above subject, I need hardly mention the seemingly evident fact that musical instrument manufacture is a favourite subject with the majority of the readers of *AMATEUR WORK*. The success attending the excellent series of papers upon the Organ and Harmonium, from Vol. I. down to the present time, proves the popularity of such subjects with the generality of amateurs, who, as a class, are known to be fond of dabbling in every art and manufacture under the sun which lies within their possible reach.

Much as I have been interested in the capital paper by Mr. Mark Wicks on the King of Instruments, and however much more I might have longed to be able to construct one for myself, I was confronted by the question, Where shall I put it when built? Then, again, a pipe organ, however softly voiced, must either have a large room or a spacious hall in which to allow room for the pipes to sound, or the effect will be lost. I was forcibly reminded of this fact a short time ago. An amateur of some standing in Essex invited me to inspect an organ he had been successful in building. The room where the instrument was could not have been more than 12 feet square, and certainly not more than 10 feet in height, and it took up a large corner of the apartment. As soon as the organ was touched, the noise was positively unbearable, and I lost no time in beating a hasty retreat. The case and instrument altogether was beautifully made, but it was sadly handicapped by the want of space to allow it to sound. Now, I thought, if this man had expended the same amount of energy and capital upon a smaller class of instrument, how

much more pleasure he would be enabled to obtain without the inconvenience I have mentioned. This set me thinking as to how I might be able to construct an American organ, an instrument I consider much beyond the harmonium in point of quietness of tone. I had then but the barest idea of how it was to be done, but after four years of experiments, failures, and successes, not to mention the cheering counsel of friends, with remarks which had reference to white elephants, I was at last successful in completing a 10-stop instrument, which I am proud of showing to my friends as my own work in spare hours.

This, then, must be my apology for introducing to your notice a subject which, I believe, has never been written upon before, for amateurs, at any rate.

Before commencing work, it would be well that we first understand the principle of construction of our instrument. I suppose most people know the action of an ordinary harmonium, but to those who do not, let me explain. First, we have a pair of bellows somewhat similar to the organ, by means of which air is forced upwards into a reservoir, and from thence through the respective reeds at the will of the performer. This forcing action, at its best, produces a more or less harsh reedy tone, which cannot be borne by musical ears for a long time together, and although expression can be obtained by experienced players through the medium of an expression stop, the tone is still somewhat monotonous and very reedy.

The American organ, on the other hand, is constructed on just the reverse principle. Instead of the wind supplying the reeds being forced upwards, it is drawn or sucked downwards through the reeds by what is known as an exhaust bellows. You can thus understand that the sound produced would be much more soft and gentle than if driven through at a high pressure. If I have not made my meaning clear, Figs. 1 and 2, showing the two methods side by side, will perhaps aid in the understanding. The arrows show the direction of the wind.

I must now go into the details of our Ameri-

can organ, keeping Fig. 2 in view. The reed, as you know, is the essential part of the instrument. The process of reed manufacture is quite out of the province of the amateur, needing very expensive machinery and many years of experience to turn out a decent toned article. The reeds, one of which is shown completed in Fig. 2, are made of thin strips of brass, riveted on to a metallic block somewhat similar to the harmonium reed, only with this difference, that while the latter is screwed to the *inside* of the sound-board, our reed is simply pushed into a cavity or cell on the top of the sound-board outside. The comparative length, width, and thickness of the vibrator will determine the pitch of the sound it gives out. The length of reeds in a large instrument, therefore, varies from 4 inches for the deepest note of the pedal bass down to a  $\frac{1}{4}$  inch, or even less, in the highest registers of the treble. Some of the larger reeds have a thick block of metal fixed on to the free end, in order to get depth of tone without the loss of room which a large reed would take up on the sound-board.

On the finish of a reed depends the quality of tone. At present four distinct tones can be made in the finishing of one piece of brass. To tune a reed, it is either scraped thinner to flatten the tone, or an imperceptible bit taken off its length to render it sharper.

Now for the application of the finished reed to our American organ. When voiced and tuned they are set in what is called a cavity-board, which has the proper number of perforations, called cells, to the number of about sixty, according to the compass of the manual and the number of stops. This tube board, with its one or more sets of reeds, as the case may be, forms the top of an air-tight box (F, Fig. 2) in which the vibration takes place, thereby producing a much fuller and more musical resonance. From this space, termed the resonant air chamber, a channel leads into the receiver or reservoir, K. The bellows (C), when acted upon by the treadles, H, are alternately distended and released, causing an exhaustion of the air in (C), and the valve, E, being opened at the same time by the key, A, a steady current



FIG. 1.—HARMONIUM ACTION.

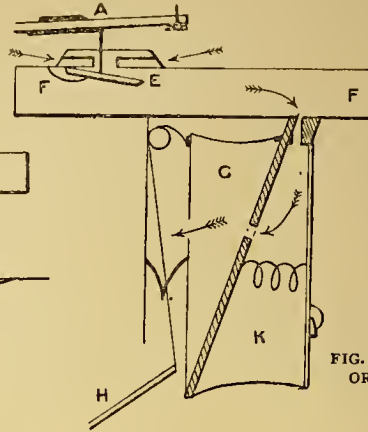
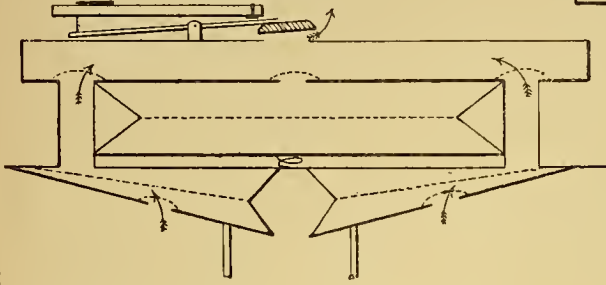


FIG. 2.—AMERICAN ORGAN ACTION.

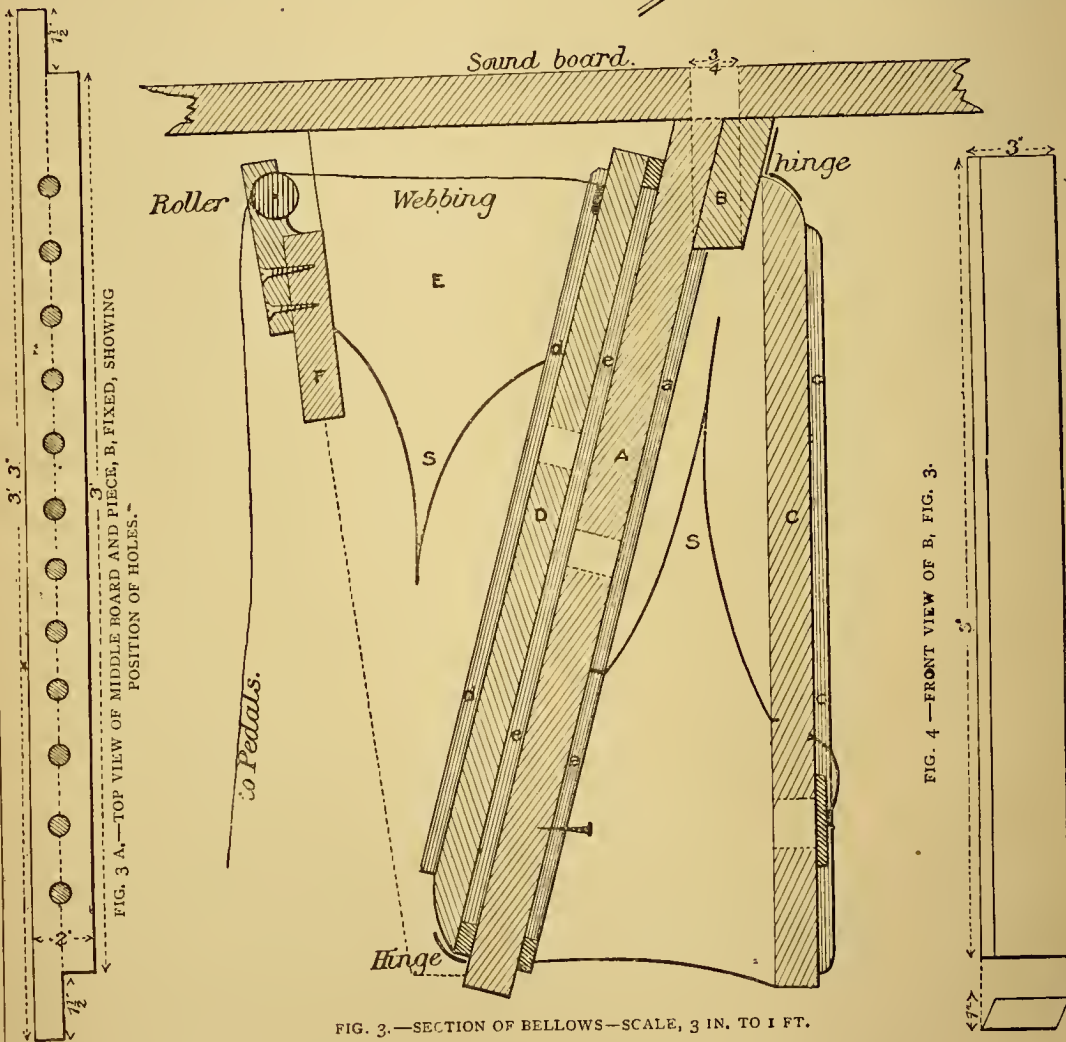
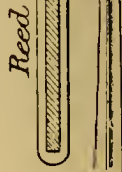


FIG. 3 A.—TOP VIEW OF MIDDLE BOARD AND PIECE, B, FIXED, SHOWING POSITION OF HOLES.

FIG. 4.—FRONT VIEW OF B, FIG. 3.

FIG. 3.—SECTION OF BELLows—SCALE, 3 IN. TO 1 FT.



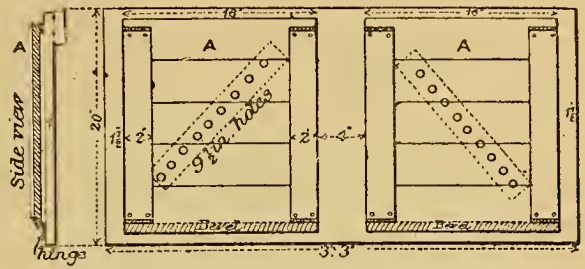
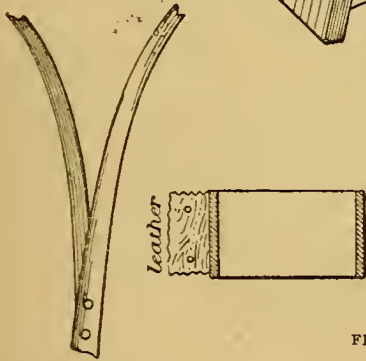
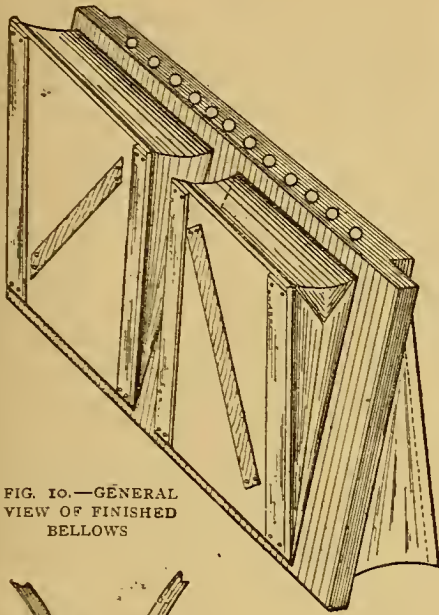


FIG. 6.—SHOWING CONSTRUCTION OF LIFTERS.  
SCALE,  $\frac{3}{4}$  INCH TO 1 FOOT.

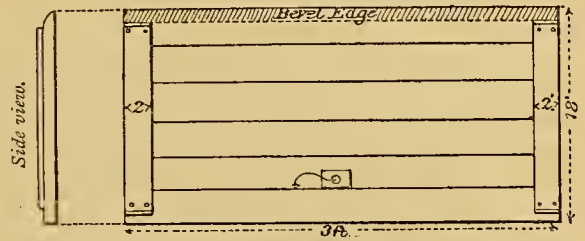


FIG. 5.—RESERVOIR BOARD—SCALE,  $\frac{3}{4}$  INCH TO 1 FOOT.

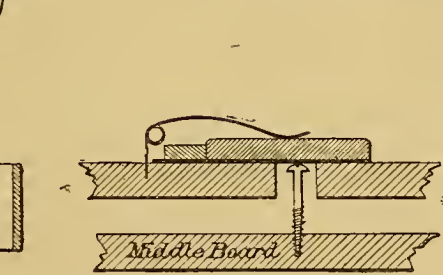


FIG. II.—PALLET AND SPRING.



FIG. 8.—SKETCH SHOWING POSITION OF BELLOWS BEFORE COVERING.

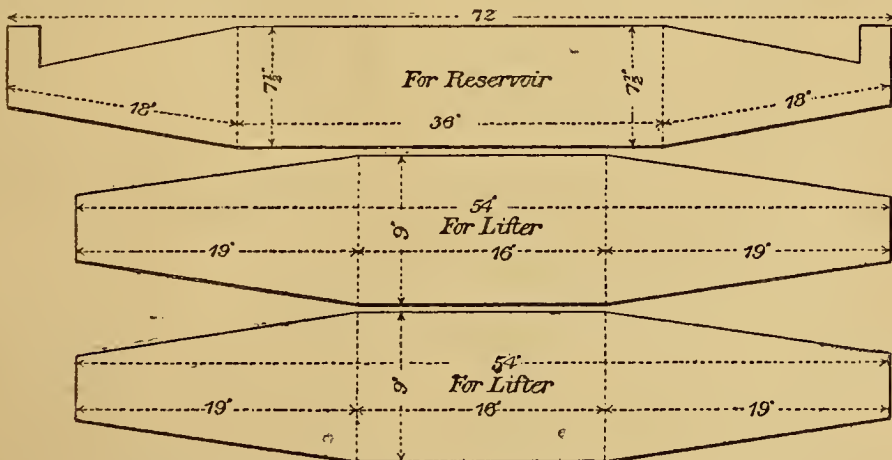


FIG. 7.—PATTERN FOR CUTTING OUT RUBBER CLOTH FOR BELLOWS.

of air is induced through the reeds, resulting in a quiet yet full pipe-like tone, until the valve is closed again. The different sets of reeds are prevented from sounding, at the will of the performer, by closing the orifices of the cells with strips of wood known as mutes, and which are connected to the stop handles.

Now that we understand a little of the principle of construction upon which the American organ is based, we may commence work in earnest.

*As to cost.*—This will, of course, greatly depend upon what parts you intend to make yourself. The reeds, cavity-board, and keys, as I have before said, are quite out of the province of the amateur, and must be bought; the latter might be made by a clever workman, but I am afraid they would be a constant source of annoyance through cyphering, and addicted to other bad habits well known to players. In fact, they are to be bought so cheaply that it is not worth while to spend the time over making them; a set of celluloid keys costing only 14s. 6d., and ivory covered at 4s. increase. Bellows may be had ready-made for 17s. 6d., and a lot of small work can be bought cheaper, quicker, and much better than we could make them at home. But if the amateur decide to make the instrument entirely his own handiwork (excepting the reeds and keys), I propose to give him such instruction thereon as will enable him to complete an instrument of which he shall be justly proud.

Although I myself spent four years in completing the organ I have in my house at the present time, there is no reason why ours need take more than a quarter of that period. I had no instruction, therefore I had to buy my own experience, often failing and making many errors for want of knowledge. My instrument also cost me more than it need have done for the same reason. But if the instructions which I propose to give in the present series of papers are carefully followed out, you will be in possession of an instrument which, for the small cost of about £8, shall be equal in worth to an organ marked in many makers' catalogues at forty guineas, and there is no reason why it should not be as good.

In the first place we must decide on the number of reeds we intend having. A satisfactory size is three rows of reeds and sub-bass, with octave couplers; two knee swells. This action placed in a solid black walnut case, surmounted with an ornamental pipe top, will make an organ well worth having. Such is the style I intend to describe. It is well within the province of an amateur of ordinary ability and common sense; but, at the same time, I must remind him that a great deal of patience and very careful work will have to be expended upon it, in order to turn out a complete success. I will do my best to make all matters as clear to my readers as possible; but if anyone is in doubt as to the clearness of my remarks, or is in any difficulty, I shall be pleased to answer any questions through the medium of "Amateurs in Council."

The following is a list of materials we shall have to buy:—

|                                                                              | £  | s. | d. |
|------------------------------------------------------------------------------|----|----|----|
| * { Reed board, 3 sets (5 octaves).                                          | 1  | 6  | 0  |
| { Voicing and tuning, at 5s. per set .                                       | 0  | 15 | 0  |
| * Sub-bass reeds in box, 13 notes .                                          | 0  | 7  | 6  |
| Wood for case (solid black walnut), say .                                    | 3  | 10 | 0  |
| * Octave coupler (Wilcox patent), (wire),<br>action, half up and half down . | 0  | 7  | 6  |
| Wood for bellows and sound-board .                                           | 0  | 5  | 0  |
| * Rubber cloth for bellows .                                                 | 0  | 5  | 6  |
| * 1 set 10 inch keys (celluloid) .                                           | 0  | 14 | 6  |
| * Stop rods and knobs (12) .                                                 | 0  | 6  | 0  |
| Wash-leather for pallets, etc. .                                             | 0  | 5  | 0  |
| * Vox Humana fan .                                                           | 0  | 2  | 3  |
| * 1 reservoir spring (for 3 row bellows)                                     | 0  | 0  | 9  |
| { 2 bellows springs, at 6d. (ditto) .                                        | 0  | 1  | 0  |
| * { 1 set valve springs .                                                    | 0  | 1  | 0  |
| { 1 reed book .                                                              | 0  | 0  | 2  |
| { 1 set valve pins .                                                         | 0  | 0  | 6  |
| Screws and extras, say .                                                     | 0  | 10 | 0  |
|                                                                              | £8 | 17 | 8  |

This will be the total cost of the finished instrument, which will consist of the following stops:—

| TREBLE.             | BASS.                 |
|---------------------|-----------------------|
| Melodia, 8 ft.      | Diapason, 8 ft.       |
| Flute, 4 ft.        | Viola, 8 ft.          |
| Dolce, 8 ft.        | Dulciana, 8 ft.       |
| Octave coupler (up) | Octave coupler (down) |
| Swell Melodia       | Swell Diapason        |
| Vox Humana          | Sub-bass.             |

2 knee swells.

The prices I have given are those quoted to

me by an American organ dealer, who has supplied me with parts, and who I have always found to be courteous and obliging—Mr. G. N. Marsh, 29, *Temple Street, Bristol*. He supplies everything at the lowest prices and of good quality, and I can thoroughly recommend him as a straightforward dealer and just the man for amateurs. His reeds, especially, are very low in price, and are the cheapest I have come across, even in London. In order to make the work easier for the intending organ-builder, I have arranged it so that the measurements I shall give from time to time shall fit in with the sizes of parts which Mr. Marsh will supply. I should, therefore, recommend you to get the parts mentioned in the above list from him. The items marked with an asterisk (\*) had better be had altogether; it will save carriage considerably, and they are sure to be wanted later on. In sending orders it would be as well to mention **AMATEUR WORK**.

Our first effort shall be expended on the construction of the bellows and bellows board. Wood, of course, is the principal ingredient. Get it from a good reliable timber merchant, or, better still, from a cabinetmaker. We shall require several deal planks of 1 inch and  $\frac{7}{8}$  inch (finished) stuff, and one plank  $\frac{1}{2}$  inch (finished). All wood must be well seasoned, and as free from shakes and knots as possible, especially the former, which would be fatal to organ work. I need hardly tell you that the work to be expended upon this part of the organ must be of your very best. Very often in harmonium work the bellows are scamped, and bad joints made with questionable glue are rampant. Nothing of this sort, mind; everything, when finally put together, must be as perfectly air-tight as it is possible to get it.

Fig. 3 is a side view of bellows. The principal part is the middle division, A. This consists of a plain deal jointed board of 1 inch thickness (when planed), 20 inches deep by 3 feet 3 inches long. The joints are to be made up and down, not lengthwise. You will find that the more joints are made, the less likely is it to suffer from warping afterwards. I need not give plain directions as to the way in which the

jointing is to be done, but refer you to ~~more~~ explicit directions given in back numbers. The work would be more satisfactory if the boards were tongued and grooved somewhat after the style of matchboarding; of course, without the beading. But do not on any account be tempted to use matchboarding; the wood is of the poorest description, and would be quite useless for organ work. Always use the best glue, and not boiled up too many times.

As soon as our board is dry, it may be taken out of the cramps and planed up perfectly true and square on both sides. It is then ready to receive the part B, Fig. 3, the dimensions of which must be 1 inch thick, 3 inches broad, and 3 feet long, as shown in Fig. 4, and bevelled to the angle shown in the illustration. This strip is to be glued and screwed firmly with stout screws to the top of our board, A, Fig. 3, leaving  $1\frac{1}{2}$  inches margin at each end. When joined together, the two pieces should be as one block. We may presently bore twelve  $\frac{3}{4}$  inch centre-bit holes from the top edge, in the position shown by the dotted lines in Fig. 3 A. Be very careful to bore quite straight and to keep the holes in a straight line, so as not to come into contact with any of the screws fixing the two parts. This little matter can easily be calculated for at the time of screwing up the piece, B, by simply marking the places where the twelve holes will come.

On the board, A, on the same side as the piece, B, is fixed, we shall want some ledges (a, a) to glue the rubber cloth to. Two pieces, 1 inch wide,  $\frac{1}{2}$  inch thick, and  $15\frac{1}{2}$  inches long; and one piece for the bottom, 3 feet long, same width and thickness. These three pieces must be mitred together at the corners like a picture-frame, the piece, B, forming the fourth side. It is important in fixing the ledges that there be no cracks between them and the middle board, and that the mitres be true, in order to keep the air from leaking in at the corners. If this is kept in view during the putting together of the various parts of the action, no trouble will afterwards be experienced by reason of various leaks, which, when once started, I need hardly say, are very difficult to find in the American organ,



for reasons which you will easily see if you have grasped the principle of construction.

The next board we shall want is the reservoir board, *c* (Figs. 3 and 5). Joint together with groove and tongue, if possible, three pieces of  $\frac{7}{8}$  inch deal, 6 inches wide and 3 feet long. These are measurements when finished, and will make a board 3 feet long by 18 inches wide and  $\frac{7}{8}$  inch thick. Bevel off the top edge 1 inch, as in Fig. 5, and strengthen by fastening a strip at each end 2 inches wide and  $\frac{1}{2}$  inch thick. Bore a hole, with an inch centre-bit, 3 inches from the edge of board, as shown in Fig. 5, and cover with a small wash-leathered pallet (Fig. 11), kept in position by a spring of moderate strength. This is the safety valve.

This board must now be hinged at the top, where the bevel is, to the piece, *b*, in such a way that the bottom edge of the board, when resting on the ledges, shall be flush with them. The hinge must be made with a strip of pliable leather 3 feet long, 2 inches wide, and a little over  $\frac{1}{16}$  inch thick; the edges must be scarfed or sliced down almost to nothing, in order that the joint may be neat. The leather that I have found to answer well is calfskin, and is dressed black on one side; it is pliable, easy to work, and does not crack. The best way of fastening is to glue and tack down with a double row of black tacks first to the bevel edge of the reservoir board, and, when perfectly dry, the other half may be treated in the same way. Leave about 1 inch at either end unfastened, in order that the rubber cloth we are presently to use for covering may be fixed underneath.

While this work is drying, we will proceed with the lifters, *d*, Fig. 3, and *a*, Fig. 6. The latter illustration will give an idea how they are to be placed on the middle board. The jointing must be done in the same way as before, the dimensions being 17 inches high, 16 inches broad, and  $\frac{7}{8}$  inch thick. Make the joints the short way of the stuff, as shown in Fig. 6, and bevel the bottom edges of each board to take the leather hinge. Two strengthening pieces are to be screwed and glued to the outside in the same manner as our reservoir board, 16 inches long, 2 inches wide, and  $\frac{1}{2}$  inch thick.

We must now prepare eight slips for ledges, 1 inch wide and  $\frac{1}{2}$  inch thick, and construct two frames the same size as our lifters. Mitre at each corner carefully, and screw down under the place occupied by the lifters on the front side of the middle board (see Fig. 6). A little careful study of Figs. 3 and 6 will make this plain.

The lifters will have to be hinged to the bottom of ledges; but before doing this we will bore through the middle board nine half-inch centre-bit holes, in a diagonal line, under each lifter, in the position shown in Fig. 6, and cover them on the *lifter* side with a 2-inch strip of pliable leather (best known in the trade as "basil"), fastened only at each end by two screws or a couple of tacks. Stretch the leather across at a medium tension—not too tight, or it will cockle down the middle; on the other hand, if too loose, it will bag, and fail to keep the air in.

Bore the same number of holes in each lifter, and cover on the *outside* with a 2-inch strip of leather, the same as our reservoir board.

When we have hinged each lifter, with two small iron butt hinges, to the bottom of the frames, fixing the hinges in the position shown in Fig. 8, we shall have completed the woodwork of the bellows, ready for covering. The bottom edge of each lifter must be covered with a strip of leather similar to the piece we used for reservoir board hinge, in order to make the hinge joint air-tight; fasten it down with tacks and glue quite firmly, only taking care to leave about 1 inch at either end, for the present, unglued, which will have to be fastened down again after the rubber cloth is fixed. I must not forget to mention that the woodwork would be all the better prevented from cracking by sizing and varnishing; but you must not varnish the edges to which the rubber cloth is to be glued. Some manufacturers use a kind of black distemper paint; but, if the woodwork has been finished off nicely, nothing will look better than varnish.

Our most difficult job, and one which will require all the patience the amateur possesses, is to cover in our work and make it complete. There are several materials used in the trade for this work; but the best material is the rubber cloth, made and sold by American organ



dealers, for the purpose. Mr. Marsh will supply the required length, which, for our bellows, is  $2\frac{1}{2}$  yards, 37 inches wide, for 5s. 6d.—a very reasonable price, and cheaper than American cloth, which I have used on my own instrument, besides its being a much more durable material. Fig. 7 will show you the pattern the cloth is to be cut. It will be better to first cut out the pattern in paper and fit it to the bellows, which, of course, must be fixed open, as in Fig. 8, while being clothed. Cut out the piece, A (Fig. 7) first,  $7\frac{1}{2}$  inches wide and  $2\frac{1}{2}$  yards long. This is for the reservoir. Glue one edge firmly to the ledges fixed to the middle board on the reservoir side, and tack with a double row of small black tacks,  $\frac{1}{2}$  inch apart. The best way, I have found, is to commence with the bottom and proceed down the two sides, and, when dry, to treat the other edge in the same way, attaching it to the edge of reservoir board. Commence, also, at the bottom, and, as soon as fixed, place into position the largest of our bellows springs, Fig. 9, and s, Fig. 3, bedding the teeth firmly into the wood, to prevent it moving out of place. The sides may now be glued down. A small piece at either end must be brought round the corner, just under the piece of leather forming the hinge, a part of which, you will remember, we left unglued for the purpose. It may now be tacked down again neatly on the top of the rubber cloth, making the joint perfectly air-tight. When this is dry, we may test our reservoir to see if it answers; but although the temptation in this direction may be great, do not on any account try the experiment before the work is quite dry and fixed. The following is a good test: Temporarily paste up the twelve holes on the top of reservoir with stout brown paper, and, when dry, push the reservoir board and the middle board together. This will drive a quantity of the air out through the two sets of holes in the middle board, and the pressure of the atmosphere outside will keep the board close up in the position we placed it. By reason of the pressure of the spring inside, the air will try to rush back into the reservoir, but will be prevented by the strips of leather placed over the holes, consequently our bellows

will, or should, remain practically a vacuum. A little air will be certain to squeeze its way in, however well the work has been done. If the reservoir resumes its natural position rather quickly, there is a leak somewhere, which must be discovered; but, if the board goes back very slowly indeed, we may congratulate ourselves on having done our work well.

Now cover the two lifters in the same way as our reservoir, cutting out the two pieces marked B in Fig. 7. Glue and tack down, first, to the ledges, commencing with the top in this case; then the side ledges. Wait until dry, when we can proceed with the attaching to the lifter board. If we have cut the piece the right length, we should have an inch over at either end, which ends must be turned round and fixed under the piece of leather covering the hinge joint in the same way as the reservoir hinge was managed, and the whole tacked down and made air-tight.

We shall not require springs *inside* the lifters, but springs are fixed outside later on. When at rest, the lifters are pressed by the springs close to the middle board, as shown in Fig. 8. There is a certain position into which the rubber cloth in the lifters should fall when at work. I cannot describe by diagrams, but you will soon find out the best way to avoid any rumpling or cracking. To test the capabilities of our lifters—if they be pulled in and out alternately, they ought to exhaust the air in the reservoir and pull the reservoir board close up until the safety valve comes into action and relieves the strain. To make this valve act, we must screw a round-headed screw into the middle board, inside, just under the pallet, to project such a distance as to push open the pallet when the reservoir board has almost closed up with the pressure of the air. Fig. 10 is a general view of bellows when finished.

In the next chapter I will give instructions on the sound-board, give designs for the sides of the case, and fit our bellows in position.

In the meantime there is enough work here to give the amateur organ-builder ample occupation until the next chapter appears.

(To be continued.)

## CONJURING APPARATUS: HOW TO MAKE AND HOW TO USE IT.

By D. ADAMSON.

I.—TO PASS A COIN INTO A BOTTLE—PREPARATION OF THE  
COIN—HOW TO PERFORM THE TRICK.

**I**T may fairly be assumed that there are very few of our readers who have not at one time or another experienced the pleasure of being mystified by some skilful conjurer, and perhaps equally few, who, when they have witnessed a good trick well performed, have not felt a desire to do it themselves, or at any rate, wished to know how it was done. Now, as every conjurer, that is, every professional, who is worth his salt has his own favourite way of working, for conjuring is work, not play, to the performer, let me anticipate probable inquiries how this, that or the other trick is done by Professor So-and-So, by saying, once for all, that I do not know. You see, dear readers, as soon as I get my pen into my hands to write on conjuring, the force of habit asserts itself, and absolute adherence to veracity is not conspicuous. Oh, don't fear that I am going to mislead you when the tricks themselves are described, only when I stated just now that I don't know, I did it so that I may be allowed to work my own show without interruption in the present volume of *A. W.*, which two letters while I write them, strike me as standing for "*A 1*," as well as indicating our favourite *Monthly*. But, like our Professor who figured in the "*Hints on Conjuring*," given in the First Series of this Magazine, I fear I am discursive, and an Editorial epistle has reminded me that space is limited.

In this paper, and others of the series of articles to follow, there is no intention of going thoroughly into the art of conjuring. A few hints which may seem necessary will be given as occasion arises for them, but what may be called the higher branches of prestidigitation—the purely sleight-of-hand tricks without apparatus, will not be dealt with. Of course, all tricks are supposed to be done without apparatus, but, as a matter of fact, few of them are. I don't say that it is visible to the audience, for in capable hands it certainly is not, and if there is to be

any mystification, the means by which apparent impossibilities are done must be concealed. If they are shown, or there is an evident concealment of something, the performance loses whatever merit it might otherwise have possessed. The things ostensibly used and shown are very rarely those on which the trick solely depends. From this it follows that, however comparatively simple, feats depending principally on apparatus instead of pure sleight-of-hand may be, they must be thoroughly studied and practised before attempting to perform in public. It goes almost without saying that those who are proficient in the various moves practised in pure sleight-of-hand conjuring, will be able to use apparatus with greater neatness and dexterity than others who have no notion of what may be called the rudiments. I allude to palming, passing, and similar moves. To give minute directions for these would take up space unnecessarily, as there are many books on conjuring which describe them fully, and it is more to the purpose now to explain and describe certain tricks and how to prepare whatever may be necessary in connection with them. Novices may be referred to Professor Garenne's "*Art of Modern Conjuring*," published by Ward, Lock and Co., for elementary directions. In stating this, it must not be understood that the tricks about to be described are altogether of an advanced character or suitable only for performance on a stage. Although it may be desirable for the amateur conjurer to give a performance of an hour or two's duration, it must not be forgotten that much amusement may frequently be derived from a few impromptu tricks, performed, as it were, on the spur of the moment. It is tricks of this class requiring only small pieces of apparatus, which can be carried in the pocket, that I shall chiefly describe, giving one or two more important arrangements just by way of a change. When going out to spend an evening rarely I go without one or two little things in my pockets, or somewhere about me, so that when I hear, "Oh! Mr. A—, do give us some conjuring," I may not be completely taken unawares. Of course, the fact of having gone prepared is carefully concealed, and it must be confessed this style of conjuring



is not unattended with difficulties from which a regular performance is free.

First of all there is the absence of the wand, the use of which, though often looked on as a piece of affectation, is almost indispensable for some tricks and a very great convenience in many others. Therefore, where a wand can be used it is better to have it handy. When it cannot be many substitutes are available, such as a ruler, a roll of paper, anything, in fact, which by being held enables the performer to hold something, such as a coin, whose presence is not suspected, in his hand. I find a cigarette, a cigar, or, better, still, a pipe, extremely convenient as a "wand," but, of course, only a smoker among smokers can avail himself of these substitutes. Still the hint is worthy of note, especially as I do not know that it has been given elsewhere. The use of these makeshifts may be very amateurish, but, then, I am writing solely as an amateur for amateurs, and am merely relating my own experiences.

Although I have referred to occasional tricks, it must not be supposed that a fair evening's entertainment cannot be given with very simple preparations and with little or no sleight-of-hand. Before concluding these papers, an arrangement which I have used with success at more than one children's "party" will be described, but, in the meantime, a sufficiency of tricks must be acquired. Perhaps it may be well to describe what a wand is for those who wish to make one, though it can hardly be regarded as a piece of apparatus. A round piece of stick, some 18 to 20 inches long and  $\frac{1}{2}$  inch or so thick, is all that is required. I have in my possession a "wand" which a professional friend of mine was in the habit of using on the stage. It is merely part of a parasol handle. After that is it necessary to say anything more about making a wand, unless, perhaps, to add that black or of some dark-coloured wood is best?

As tricks with coins form an important part in every conjurer's repertoire, and the needful preparations are easily carried without exciting suspicion, let us start with one of them. For this particular trick, which consists in getting (apparently) a borrowed penny into a glass bottle, the mouth of which is obviously

too narrow to admit it, the only special thing needed is a prepared penny. The existence of this, it is scarcely necessary to say, is not mentioned to those before whom the trick is being performed. It is, in fact, the apparatus, or what is familiarly known as such, for performing the trick. Although a penny has been named, it must not be supposed that other coins would not do as well; but, for obvious reasons, the humble "copper" is preferable to the florin or half-crown, while, apart from the difficulties of preparing them, the use of small coins would rob the trick of its appearance. Apart from size, it is necessary that the prepared coin should be one of the ordinary currency, for the trick being performed with, or supposed to be performed with, a borrowed coin, for which the prepared one is secretly substituted, it would never do to have this of a different kind. This rule applies to all coin tricks depending on the substitution of a prepared piece for one which has been borrowed for the occasion, so that, though a penny has been named in this instance, residents abroad must use a current coin of similar size. Thus, in France, one would naturally use a 10c. piece.

Having said so much about the general principles regulating coin tricks, let us take up the present one. Now, though a penny cannot be got through the neck of an ordinary wine bottle, if the penny be made collapsible, so that it can, as it were, be folded up, the difficulty vanishes. Another essential is, that the coin, after having been passed, when folded, into the bottle, shall at once resume its original form, so that it can be shown to the spectators under the supposition that it is the actual penny which one of them had lent.

Having a general idea of what is wanted, no one will have any difficulty in understanding the following description of the preparation of the penny: First of all, a groove must be cut into the rim, all round the coin, to the depth of, say,  $\frac{1}{16}$  inch. The depth is not of much consequence, provided it be sufficiently great for a very small elastic band to be inserted, but it should not, at the most, be wider than one-third of the thickness of the edge. As so much



depends on this groove, in order to prevent any possibility of a mistake being made, a diagram (Fig. 1) is given, showing, on an enlarged scale a section of the prepared rim. There are, at least, two ways in which this groove may be cut, and it will be sufficient to say that they are made by turning in the lathe or sawing with a fret-saw. I prefer the latter, though it is slower; and as those who possess a suitable lathe, if they wish to turn the groove, will know how to act, it will be only necessary to throw out a few hints

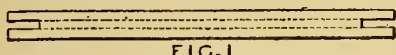


FIG. 1.

DIAGRAM SHOWING GROOVE ROUND CIRCUMFERENCE OF PENNY.

for the benefit of others who decide on using the saw. Of course, it will be understood that this must be used in a hand-frame, and not in a machine. For the size of blade, an ordinary No. 2 or 3 will be found suitable, though, from what has been said, it will be seen that other numbers may be used. Perhaps it will be as well to say that the narrower the groove, provided it be sufficiently wide to admit the elastic, the better, as, in case of close scrutiny while in the bottle, the cut is less likely to be perceived. While sawing, the coin should be held in a small vice, and oil be freely applied to the blade.



FIG. 2.

PENNY WITH STRAIGHT CUTS.

This part of the work having been done, the next thing is to cut the penny into three portions. This may either be done by a couple of straight cuts, as shown in Fig. 2, or, better, as in Fig. 3. From this it will be seen that the cuts are so arranged as to form a projection and corresponding hollow in two contiguous parts. The advantage of this arrangement is, that when the coin is being handled in performing the trick, the pieces do not so easily get displaced;

for it must be obvious that, with straight cuts, when the coin is distended or flat, there is nothing beyond the elastic band to prevent a sliding movement as well as a folding one. With the notched cut the parts key into each other, and, while folding can be managed with equal facility, it is not possible to move the pieces edgewise. Whichever method be adopted, the actual cutting is done with a fret-saw, and it is not necessary that great accuracy in sawing straight be observed. The great thing is to get the penny divided into the three parts of approximately equal width. A fairly large blade may be used for this part of the work, as a moderate saw kerf is not distinguishable afterwards. While mentioning this, I may give another variation in cutting, by which the saw



FIG. 3.

PENNY WITH ALTERNATIVE CUTS.

is made to follow as much as possible the outlines of the profile. This, of course, is much more troublesome to manage, and it can hardly be considered that the advantage gained is sufficient to warrant it being done, as the cut is only partially concealed on one side. The coin being now ready, a very small elastic band must be placed in the groove, all the parts being in their proper positions, so that, beyond the slight mark separating them, the penny looks as usual. It will be found that the tension of the band keeps them close together. The elastic being sunk, on folding the parts over each other and releasing them, they will spring out flat. This is all the preparation necessary, but a few hints in connection with the trick will not be out of place.

The elastic bands are much smaller than those usually sold at the stationers', and are such as those often used by chemists, from whom I have got them. As the bands soon get

cut by the sharp edges of the coin, it is always well to have one or two of them in reserve, and to test the one which may be on the coin immediately before using. If this precaution be taken, it will save the annoyance of the trick failing through three pieces of a penny instead of one entire coin being seen inside the bottle. At first, the brightness of the metal where it has been cut renders it advisable that a freshly-prepared penny should not be used. The brightness, however, very soon wears away, and seen through an ordinary bottle, the cuts will escape notice.

Having mentioned all that seems necessary in connection with the preparation of the penny, a short space may be devoted to its use, though those who are conjurers will have surmised, from previous remarks, what has to be done. When giving a regular performance, during which placing the penny, or rather a borrowed penny, in a bottle, is taken in due course as part of the performance, the "patter" should be prepared beforehand, and may be arranged in any way which may seem desirable. When, however, the performer does it simply because he is asked to, or wants to show a trick without any previous preparation (of course!), he must adapt his patter according to circumstances. For example, if asked to perform, he can raise an objection after the style of so many ladies when they are asked to sing. Of course, the first "No," or its more polite or wordy counterpart, will not be taken as final, so that there is ample time for him to get the prepared coin from whichever pocket it may be stowed away in. After that, he can go ahead any time by borrowing a bottle with a neck large enough to admit the folded penny, but plainly too small to allow an ordinary one to pass. This latter, of course, must be borrowed also; and if a choice of several is offered, it would be just as well to pick out one which is worn to about the same extent as the concealed one. The precise kind of bottle is unimportant, but it should be sufficiently transparent to allow the coin being so plainly seen that there is no doubt about its being there; and, on the other hand, it should not be of such clear, fine glass that the coin can be too

minutely examined. The best shape for the bottle is that in which the neck gradually widens instead of coming to an abrupt shoulder, as it does in ordinary wine, beer, and other bottles. The formation required is found in champagne and the old-fashioned soda-water bottles; indeed, all things considered, there is nothing better than this latter; the shape is right, and the glass, while white and transparent, is not so thin and fine as to allow the marks on the coin to be clearly recognized. Having obtained the bottle, it must be held in one hand, the other containing both the borrowed and the prepared pennies. The substitution of the former for the latter may be done at the instant of inserting it into the bottle; but this requires much neatness and skill, which cannot be acquired without a considerable amount of practice. Those who have leisure to devote should, however, practise "ringing," as changing is technically called, as it is sometimes awkward otherwise, when attempting to do a trick after being driven into a "tight corner." Still, those who cannot acquire the sleight-of-hand which this implies may very well manage by effecting the change at any time that may be most convenient, and actually show the prepared penny instead of the other. Of course, no one must be allowed to touch it; but, if the borrowed one has been handed round for examination, no one is likely to want to do so; and if the bottle be examined after the coin, there is plenty of opportunity of easily making the change. I prefer this somewhat leisurely way of "ringing," for many reasons, and always adopt it instead of the other when at all possible, as it generally is. During the examination, or even when taking the bottle into the left hand, no one thinks of noticing what the right hand is doing, and, as the trick is not supposed to have commenced till the performer has both bottle and penny in hand, the prepared coin escapes criticism. After an amount of talk, the penny and the bottle being visible the whole time to the audience, the penny is passed into the bottle by folding it, while apparently forcing it in. During this part of the performance the backs of the operator's fingers should be towards



the audience, who, as the time required to fold and pass the penny in is only momentary, will never notice the little move. The coin, of course, is heard and seen to pass into the bottle; and what more can be required by the most exacting? The bottle may be taken round, but it is not a good plan to allow anyone else to take it in his hands, as is sometimes requested. Diplomacy, from a conjurer's point of view, may be required, as it would never do to refuse point-blank such an apparently reasonable demand. If anyone really insists, just make the slight mistake of supposing that he wanted to see the penny again; and that he may do so without inconvenience, get it out of the bottle. Of course, in doing so, take care to change the coins again. But without describing how this can be done alone, it will be better to explain how to get the penny out, as this and the change are really the same move. Well, then, to get the penny out, the bottle must be held by the neck in the hand which contains the borrowed penny, mouth downwards. By shaking it with a circular motion the penny will conform to the shape of the bottle, and work its way out into the hand, when the original, or borrowed penny, with which it will be supposed everything has been done, can be allowed to drop on the floor. Both it and the bottle can then be examined *ad lib.*; and if anyone wants to know how it is done, as in a private company someone is sure to, tell them you melted the penny till it got soft, or that you folded the penny up small. This, though correct, will not be believed more readily than the other; but, having told you how to do the trick, I must leave you to your own devices in explaining to others how not to do it. According to programme, now comes "the interval"—till next month, when I hope we may meet again.

A NEW JOINT-MAKING MATERIAL.—A permanent and durable joint can, it is said, be made between rough cast iron surfaces by the use of mineral asbestos mixed with sufficient white lead to make a very stiff putty. This will resist any amount of heat, and is unaffected by steam or water. It has been employed for mending or closing cracks in cast iron retorts.—*Scientific American.*

## GALVANIC BATTERIES.

By ALLAN TRAYNOR.

I.—THE FIRST BATTERY—SIMPLEST FORM OF CELL—WHAT A BATTERY IS—THE ELEMENTS—AMALGAMATING ZINCS.



THE discovery of the voltaic battery, eighty-nine years ago, has made the century in which we live an electrical one. Electricity could certainly be generated long before a battery existed. A glass rod, rubbed with silk or flannel, would attract pith balls or other light substances. A plate of glass, mounted on an axis and driven against a silk rubber, would produce an electric spark. However beautiful as laboratory experiments, the results obtained were of no practical value. The advent of the battery opened up an immense field for electrical research. The results were the discovery of new and unexpected phenomena, their chief importance being that they were not confined to the laboratory, but they could be put to practical utility.

The first battery was constructed by Volta, and known as the Voltaic pile; it was regarded with a great amount of wonder in its day. Volta arranged several pairs of copper and zinc plates in the shape of a column. Copper and zinc were soldered together; this constituted "a pair." The zincs all faced the same way. To secure a good conductor, and at the same time prevent metallic contact, pieces of cloth, saturated with weak sulphuric acid, were placed between the pairs. When the plate at one end of the pile was connected by a wire with the plate at the other, a steady flow of electricity passed from one end to the other. When a more powerful current was wanted, the number of pairs was increased and connected as described. Volta could give electric shocks with his pile; and when two pieces of charcoal were attached to the ends of the wires and made to touch, the electric light in its infancy was shown by a flash.

The simplest form of voltaic cell consists of a plate of copper and a plate of zinc placed in a vessel of water, to which are added a few drops of sulphuric acid. When a wire is attached to that part of each plate which is



outside the liquid, and the free ends of the wire made to touch (Fig. 1), a current of electricity is generated, and kept up by the action of the liquid on the zinc. The current is set up, first of all, at the surface of the zinc plate. Passing through the liquid, it gets out by the copper plate, then through the wire and back to the zinc again. There is no current without a complete circuit; that is to say, the plates must be united by a substance which conducts electricity. All the metals are electrical conductors, silver being the best and copper coming next. From its cheapness, the latter is universally employed. The circuit is the path along which the current travels; it includes plates, liquid, conducting wire, and whatever work the current may be doing. If the circuit be broken, as by cutting a wire or taking a plate out of the liquid, the current at once ceases.

The question may now be asked, "What is a battery?" Properly speaking, a battery is a combination of voltaic cells; not one cell, as is commonly supposed, but two or more coupled up together. Each cell contains two different substances, called the elements, one of which is consumed by the exciting fluid. Both substances must be conductors of electricity. The substance which is not consumed is called the *negative element*, and that which is consumed the *positive element* of the cell. It is not necessary that both elements should be metals; very frequently only one of them is a metal. The substances commonly used as elements are, zinc for the positive and carbon for the negative.

The zinc is called the positive metal, plate, or element, because the current begins at its surface in contact with the liquid, and the action gradually wears it away. It may be compared to the coal of a steam-engine: the zinc is the fuel of the cell. The wire which comes from the zinc is called its *pole*, this term including not only the wire, but also that part of the plate which stands free from the liquid. It is named the *negative pole*.

The carbon (or copper) plate is called the negative element, and the wire which comes from it, and that part of it not immersed in liquid, is its pole. It is named the *positive pole*.

Much confusion frequently arises from the terms positive and negative *element*, and positive and negative *pole*. If we bear in mind that the term element applies only to that part of the plate immersed in the liquid, and pole to that part which is outside the liquid, there should be no difficulty in grasping the meaning of the terms. Positive is meant to express that which gives off current. In every case current is given off from the negative plate. It is generated, first of all, at the zinc, but it is given off by the negative plate. Hence the carbon or copper, though the negative element, is the *positive pole*, and the zinc, though the positive element, is the *negative pole*.

For practical purposes, the form of cell described above is of little use. Its chief value arises from the important lessons it teaches. We learn that when copper and zinc plates are first immersed in weak sulphuric acid, and a circuit completed, a current of electricity is generated. Is it a constant current? No; it lasts only for a few minutes, the loss being caused by what is known as *polarization*. The copper plate becomes covered with a film of hydrogen gas. The gas prevents contact between the liquid and the copper. Further, hydrogen gas, being itself a positive and copper a negative substance, an opposing current is thereby produced which weakens the original current.

*Zinc and Carbon.*—It has been already stated that the elements most commonly employed are zinc and carbon. A few words on each of these will be necessary. When used in a porous pot zinc is commonly cast in the shape of a rod. When this is done, only the best zinc cuttings should be employed, from which all parts of solder should be removed. When it is intended, as in the Bunsen or bichromate cell, to be used as a cylinder or a plate, rolled sheet zinc is the best. It may vary in thickness from  $\frac{1}{16}$  inch to  $\frac{1}{4}$  inch. A saw may be used for cutting it to any size, or the simpler method may be resorted to, of making a deep score with a bradawl or other sharp point, running a drop or two of sulphuric acid into the score, then a drop or two of mercury, and allowing the chemicals to eat into the metal, when it can be easily broken. Zinc

can also be formed into a cylindrical shape by holding it before a good fire till it becomes too hot for the hand. It may then be bent round a piece of wood, leaving  $\frac{1}{2}$  inch of space between the two ends, Fig. 2 A.

Before zinc is used in cells containing acid solutions, it ought to be thoroughly amalgamated with the purest mercury that can be obtained. This process is to prevent what is known as *local action*, which is caused by impurities in the zinc. Were it possible to obtain zinc perfectly pure, it would be consumed very slowly in a battery with open circuit; but ordinary zinc is continually consumed, whether the circuit be open or closed. The object of amalgamation, therefore, is to protect the zinc by bringing it into a more homogeneous state, thus rendering it a better source of electricity.

Amalgamation is performed by, first of all, clearing from the surface of the metal every trace of grease. This is done by washing in a strong solution of soda, and employing a hard brush. The cleansed metal is then placed for a second or two into a vessel of water and sulphuric acid, in the proportion of one part of acid to one-tenth of water. It is then placed in a separate vessel and the mercury is poured over it, a rag dipped in the acid solution being employed to rub it thoroughly till the entire surface of the zinc has a bright silver colour. One fault must be guarded against—that of putting on too little mercury. The more thorough the amalgamation the greater the saving of zinc. The operation complete, the plate or cylinder should be set on



FIG. 2 A.—ZINC CYLINDER TO WHICH A STRIP OF COPPER IS SOLDERED FOR CONNECTION.

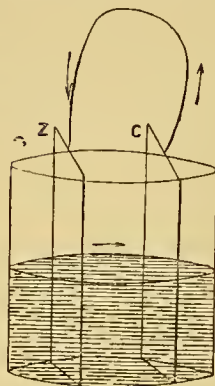


FIG. 1.—SIMPLE CELL, SHOWING THE DIRECTION OF CURRENT WHEN ZINC (Z) AND COPPER (C) ARE IMMERSSED IN DILUTE SULPHURIC ACID, AND THE CIRCUIT COMPLETED.

edge to drain, and before being placed in the cell it should be examined for any drops of mercury adhering to the edges, which should be shaken or brushed off.

It may be well to mention here that amalgamation should always be performed in a well-ventilated place, as the fumes given off by the zinc in contact with acid are very unhealthy. It should also be noted that all bending and cutting of zinc, into whatever shape may be desired, must be complete before amalgamation begins. The action of mercury on zinc renders the latter very brittle; and should any attempt be made to bend the amalgamated zinc, the result will be disaster—the zinc will break.

When zinc has been at work for some time, it may begin to show a greyish colour, and a hissing sound may issue from the cell. Re-amalgamation is then necessary.

(To be continued.)

## A MODEL PUMP WORKED BY WIND POWER.

By REV. A. THOROLD.

I.—NECESSITY FOR SIMPLICITY OF GEAR—HEIGHT TO WHICH WATER CAN BE LIFTED—THE LIFT PUMP.



AFTER the first portion of the paper on Wind Models was in print, a letter was forwarded to me by the Editor of AMATEUR WORK which he in turn had received from a subscriber to the magazine. The letter was from a gentleman who signed himself "Dead-beat," and it appeared, on investigation, that the beating from which this sufferer had died was given him by a force-pump, which, after refusing to be guided in its proper sphere of action by the gear of a windmill, had turned upon its constructor, and finished him off for good. Feeling that it was a decidedly important case, I replied that I could hardly deal with the matter in a private letter to "Dead-beat," but that, if the Editor approved, I would add a few pages to my paper, although it was really concluded, to help our friend over the difficulty.

In the course of my paper, I had written that the principle of wind gear, might, if needed, be

applied to a force-pump, for the purpose of supplying miniature fountains, etc., with water; but as the subject was beyond the scope of the paper then in hand, it was not my intention to do more than allude to the possibility. The remark evidently fell like balm upon the troubled mind of "Dead-beat." "Dead-beat" had, we may suppose, before he read our paper, grappled with this idea of working a pump by the agency of a windmill. But when he came to erect his model, apparently, according to his confessions, every change of wind took his sails out of gear. Hence, although the mill probably still went round right well, the pump did not move, and no water rose as desired. "What," he writes, "is to be done. I have tried all ways, but the sails go out of gear. I should be glad if you could advise me how to proceed, I am 'Dead-beat.'"

I may begin by saying that I have not seen "Dead-beat's" models, nor any drawings of his unfortunate attempts. Apparently he has had in hand a somewhat complicated affair, if we may judge from the fact that he has set up what is capable of being in or out of gear. There is a rule, golden in all machinery, just as in many other things, "Simplicity is best." The most successful patents, and those which have brought the largest fortunes to their possessors, are those in which the simplicity is so evident that the wonder is no one thought of it before; and it is the same wherever we look. Let us then start by saying that we must aim at some scheme in our combined wind and water model, in which the works are simple, and so simple, in fact, that a change of wind cannot put them out of gear. I will do my best to follow my own prescription, and give a simple account of such a model.

It may be well to start by saying that we must not expect very great things of a small

model. Where a full-sized machine driven by the wind may answer very well, a small one may not give such good results. There are several reasons for this. A large and heavy windmill gains a force and velocity which is not possible in a mere toy. Then, the wind a few feet from the ground has not the same power that it has at an altitude of 40 feet. Then, again, the fittings of a large mill are perfectly accurate and well finished, while every inequality in our amateur work will increase the friction, and more than proportionally diminish the actual amount of work done.

These are primary and real difficulties, and must be amply allowed for unless we wish to be faced with much after disappointment.

Before we commence the construction of our model, it will be advisable to pay a personal visit to the nearest lift-pump, or force-pump, for they are the same things, and make an experimental examination of its various parts.

First, let us take the handle, and do five minutes' honest pumping. This will give us a better practical assurance than any amount of writing, or reading, of the power required to lift, or force water above its own level, and of the meaning of the terms "force," or "lift," as applied to a pump.

The power necessary to be exerted is dependent upon two

things: First, on the accuracy of the pump fittings; and, secondly, on the height of the tank above the pump, into which the water has to be carried.

A moment's consideration will show why these points govern the amount of power required to be exerted at the handle.

Since every foot of length in the suction pipe means a greater amount of air to be withdrawn from the pipe before the water will move upwards, any leakage through an ill-fitting

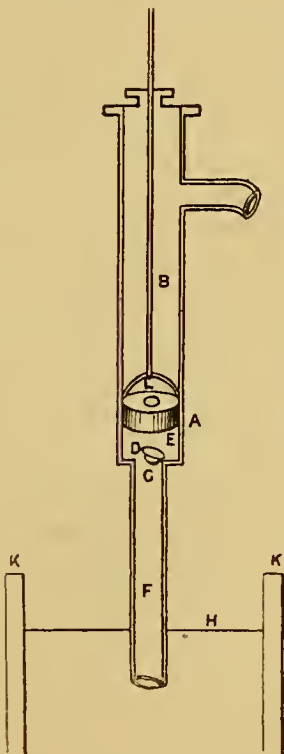


FIG. 1.—SECTION OF COMMON LIFT PUMP.



piston, or valves, is tantamount to a corresponding loss of the height of the water in the pipe.

The reverse of this takes place as we increase the distance to which the water has to be carried after it has been brought past the delivery valve. Here, of course, again, owing to its weight, the force of the water is at its new level, downwards, and against the column of water below it. Hence, each time a fresh volume of water is passed through the delivery valve, the column of water already there, and undischarged, has to be lifted further up in the pipe, and every extra foot of water there signifies an extra foot column of weight bearing down against the upward force of the pump.

From these considerations it is clearly of great importance that the suction and delivery pipes of our model shall be as short as practicable; that is to say, the tank into which the water is to be pumped, must not be at a greater height above the reservoir from which the water is drawn, than can be helped. In fact, in our model it will be better, as far as possible, to arrange that the suction pipe shall be considerably longer than the delivery pipe, but within the limits of length, respecting which a few words will be said. With this arrangement before us, it is, however, important to bear in mind that there is a practical limit to the length of the suction pipe, that is, of the distance between the body of the pump and the surface of the water. It is a scientific fact that if the distance between the body of the pump and the surface of the water exceeds 34 feet, no water will ever be raised, since the atmospheric pressure is never capable of supporting a higher column than 34 feet of water. Indeed, in practice, considerable deductions must be made from this limit. Supposing even that the working parts could be made so perfect as to produce an absolute vacuum in the suction pipe, the varying pressure of the air would only occasionally allow so high a column as 34 feet to be raised. The barometric column in England varies between 28 and 31 inches in height, and this does not represent an average of more than 30 feet in a column of water. If, therefore, the surface of the water to be raised

exceeds this depth below the level of the ground, it will be necessary to erect the body of the pump in the well itself, at a certain moderate distance from the surface, and to lengthen the piston rod, so that it may be conveniently worked from the surface.

This is the arrangement adopted for raising the drainage water from mines.

Bearing in mind the general law of atmospheric pressure, the action of a pump is not difficult to understand; and that we may have our work perfectly plain before us, it will not be out of place to remind those of our readers who may not have the matter at their fingers' ends, not only why, but how, also, water rises from the well on certain movements of the pump handle. Fig. 1 shows a section of a common lift pump. Supposing the piston, *a*, to be at the bottom of the barrel, *b*, and to be drawn upwards, a vacuum, or empty space, would evidently be left between the bottom of the piston, *c*, and the bottom of the barrel, *d*, were it not that air from the pipe, *e*, forces open the valve, *g*, at the bottom of the barrel, and follows the piston. But in proportion as the air quits the pipe water enters it, and remains suspended therein by atmospheric pressure, acting on the surface of the water, *h*, in the well, *k*. The piston having been raised to the top of the barrel is now forced down, the lower valve closes and the air in the barrel forces open the valve in the bucket, *l*, and escapes. On again raising the piston the barrel is again filled with air from the pipe, and is again expelled through the valve in the bucket when the piston is once more driven down. In this way, by a few strokes of the piston, the whole of the air is drawn out of the pipe, and water rises in its place, provided, as already has been said, the height does not exceed 34 feet, at about which height it is balanced in the pipe by the pressure of the atmosphere on the surface of the water in the well.

We shall now be able to proceed to the construction of our model, with a tolerably clear understanding of the "why and wherefore" of what we are doing—a very necessary precaution if we wish to do good work.

## A HANGING WATCHSTAND.

By ELECTRON.



THE watchstand about to be described, is taken from one I made, to hang on the wall of my room. I soon received commissions for several more, from friends who were unable to make them. The construction is very simple; the piercings are cut in four different boards, which are built up, or glued one upon the other.

Fig. 1 is a front view, the light shaded parts are stained, the white parts are left the natural colour of the wood, and the whole is varnished over, the dark-shaded parts are covered with velvet.

Fig. 2 is a side section, showing the joints of the four boards, and also the bracket at lower end, for the end of chain and seals to rest on; the top of the bracket is covered with velvet, the grain of the wood of bracket, and second top-board, are fixed cross-ways, to prevent the wood from warping.

Procure four pieces of clean dry yellow pine  $\frac{1}{4}$  inch thick, of the following sizes: one piece 11 inches by  $4\frac{1}{2}$  inches, one piece  $7\frac{1}{2}$  inches by  $4\frac{1}{2}$  inches, and two pieces  $3\frac{1}{2}$  inches by  $4\frac{1}{2}$  inches; these must be planed up level, the edges squared, and gauged and planed to  $\frac{3}{8}$  inch thick, then mark on the longest board the moulds at lower end, the cusped openings, under the three-centred arch over the bracket, and the triangular top; these must be cut out with fret-saw, or with chisel and gonge.

Take the next longest piece, and cut the three-centred arch at lower end, and the two piercings under the ring where watch hangs; cut in the next piece the cusps under top Gothic arch, letting the grain of wood run across, then cut the Gothic arch in the remaining piece, and glue them together, putting a heavy weight on them, or cramping them together; small brads may be used, but if glued and cramped, or weighted, it will be sufficient.

Now try the edges, and if not quite square take a little off, and cut the tops of the three top boards to the triangular form, as cut on the

longest board, and see that the edge is square from face.

Next prepare the two corbels or brackets fixed at the base of triangular top; they should be made the same thickness as the four boards already glued up; they can be glued, and fixed by one or two brads, fix underneath them a  $\frac{3}{8}$  inch bead mitred across the end, and returned at the inside end; under these beads fix the two moulded blocks as shown.

Next prepare the capping, about 12 inches long,  $\frac{1}{2}$  inch thick and about  $1\frac{1}{8}$  inches wide, a small hollow is worked on the underside; it must be cut to the proper lengths and mitred, being careful to get good joints at the mitres. It can be glued on and fixed with brads; but before fixing the two pieces on the corbels, the ends should have the hollow worked across them, and the two balls which rest on them must be fixed by two fine screws passing up from the underside. Turn the balls out of a piece of plane tree, and be careful to get them both one size and height, and the bases square, so that they stand perfectly vertical. The top ball must also be turned and notched to fit on the top, and fixed by brads being careful that it stands vertical.

Turn the top piece of the bracket out of a piece of plane tree  $\frac{3}{8}$  inch thick, mould the edge, and make a recess on the top for the velvet  $\frac{1}{8}$  inch deep, as shown on Fig. 2.

The lower part of bracket is turned from a piece of plane tree, and it and the top sawn across the centre, with a fine saw, then glue the bracket on, fixing it by screws from the back. Next turn a ring of plane tree for the watch to rest in, it is about  $\frac{3}{8}$  inch wide and  $\frac{1}{4}$  inch thick, with a hollow worked on each side; it should be made to fit the watch which is to hang on the stand, and is glued on.

Make the whole perfectly smooth with fine glass paper, and give it a coat of size, then stain the parts shaded light, and varnish the whole with two coats of copal varnish. Fit into the ring and top of bracket, a piece of velvet glued in with thin glue, and also glue a piece of velvet behind opening above bracket, the velvet should be weighted till dry.

Cut out a piece of sheet brass, and screw it

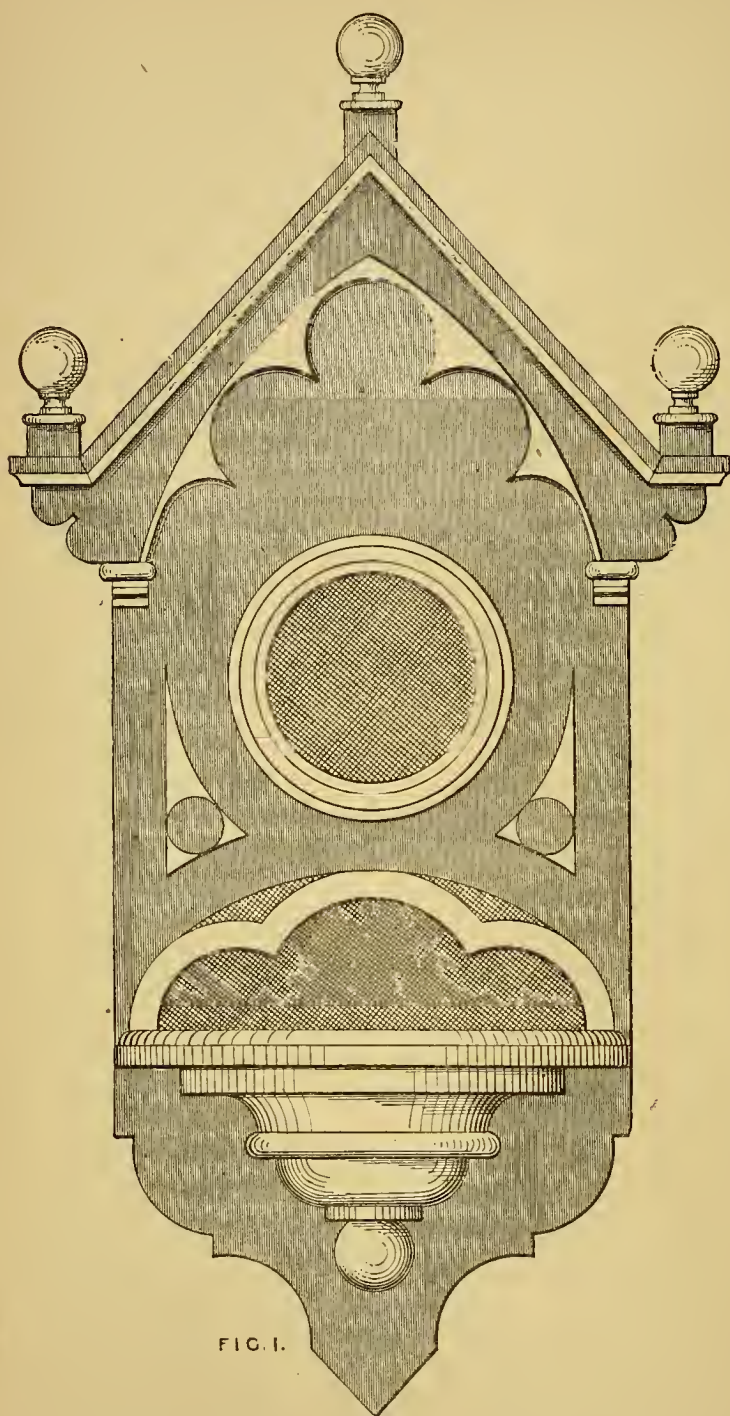


FIG. 1.



FIG. 2.

FIG. 1.—FRONT VIEW OF WATCH STAND.

FIG. 2.—SIDE SECTIONAL VIEW, SHOWING CONSTRUCTION.



to top end at back, with a piece projecting about  $\frac{1}{2}$  inch above point, in which drill a hole to hang the stand.

A hook must also be fixed over the ring to hang the watch on; it can be made out of a piece of brass wire  $\frac{1}{8}$  inch diameter, and turned with a pair of round-nosed pliers, and the end screwed; the watch must be tried on before screwing the hook in, so that it hangs exactly in the ring when hung.

Where brads are used, the heads should be punched down, and the holes filled with putty the colour of the stain.

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## FITTING UP A WORKSHOP.

By REV. ALGERNON THOROLD.

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I.—INTRODUCTION—BEST POSITION FOR SHOP—MATERIAL FOR FLOOR—STOVE OR GRATE?—OBJECTIONS TO INDOOR WORKSHOP—PAPER AS A BUILDING MATERIAL.



FROM time to time we are favoured in the illustrated papers with a glimpse in black and white of the studio of some well-known painter. Sometimes the great man himself looks at us from the opposite page, while we are conning his work and cosy corners. Here stands a model in plaster of Paris, there an easel, draped, and upon it the last work of the genius hand. Everything is made to wear the appearance of luxury and comfort, and we wonder how on earth the Indian carpet has not been spoilt by drops of oil and blobs of paint, and whether everything in reality looks so spick and span as it is made to appear. Such crude ideas, are, of course, the result of ignorance; great men never drop their oil, and paint is much too expensive to waste on the carpet: it pays better to spoil the canvas with it at five hundred guineas a yard. Great painters in old days handed down to posterity portraits of themselves from their own brush, though how they ever looked at themselves with one eye, and at their work with the other, is one of those things which, as Lord Dundreary used to say five and twenty years ago, "no fellah could understand." However, as we are not called upon to pass the "Little-Go," or "Smalls" on the subject, we

will not pursue it lest the Editor should decline to allow the argument.

Talking about the Editor, why not ask him to furnish the readers of AMATEUR WORK with portraits (full page) of all the masters of their craft who write for this magazine, and why not have a series of sketches of their studios or workshops? But, joking aside, by the Editor's leave, here is a paper on a workshop. We hear of the model dairy, the model farm, etc., and why not the model workshop also? Doubtless we should all have very different ideas as to what constituted a model workshop; size, position, equipment, would in different minds have the chief position. Nothing, to some, would be more disagreeable than a shop, between which and the house there lies a stretch of sky, to others this would appear an advantage; one would prefer a small shop to a large one, the first he can keep warm and snug, the last is always draughty and comfortless. One prefers a few tools and good, another a large number, even if some of them are indifferent. A model workshop must, of course, combine all the best points as far as possible, and omit the doubtful ones; but as it is not necessary that we should look for perfection, such a good and fairly appointed shop need not perhaps be very difficult to provide.

One of the chief essentials in any workshop is plenty of light; nothing is more detrimental to work, than for it to be perpetually lying in a shadow; in many shops, however, a bad light is the rule, one window is the general thing, hence unless the window, by a happy chance, is well situated for the bench, great loss of time in working, and much indifferent work must result. It may be said that the bench should be placed to make the best use of the light, that, of course, would be done, but generally the bench will not, from its length, stand in any position but one. The best light is that which comes from overhead, especially if it can be arranged for the skylights to look north, but a one-storied building is always necessary for such an arrangement, otherwise it is out of the question. In lieu of this we should aim at the bench end looking towards a north window in the wall, and if possible contrive for another at the further end also.

But the best arrangements have their disadvantages, and sometimes, on a sunny day, the light and the heat may be over great where skylights are used. It is possible, of course, to provide even against this by roller-blinds, but if this be thought unworkshoplike a little white-wash and lime painted over the glass will meet every need. After the light, the next most important consideration is warmth and dryness; the first not less for ourselves than for our material, and the latter for the sake of our tools. If our shop is an out-building, it will, of course, be furnished with a floor of some sort, boards are best, but bricks or stamped clay are admissible. Bricks, perhaps, seem to draw the damp more easily, though in this respect the appearance is worse than the reality. All difficulties of this sort, however, may be overcome whether the walls be thick or thin, and the floor brick or wood, if we aim at having a good stove. A stove is better in many ways than a fireplace, and if the latter is already *in situ*, it will be advisable to fill it up with a plate of sheet iron and fix a stove in front. It will be found in practice that a stove draws up more quickly than an open grate, and standing into the workshop, far more warmth is obtained than would be possible under any other plan. In putting a stove, do not forget a damper in the chimney, to assist or retard the draught.

If the shop is conveniently situated for it, great convenience will be found in erecting a water cistern or tub, and bringing therefrom a pipe with a tap into the workshop. It often happens that we get our hands into a disagreeable state which we are apt to neglect if it is necessary to make journeys now and again to the house. No great difficulty or expense is incurred by this proposed arrangement; a short length of down pipe can be easily led from the roof into an empty paraffin barrel, which should be raised as high as possible from the ground, and when a connection has been made with the shop by a short length of lead pipe, our water supply will be a constant one without the intervention of the New River Waterworks Company.

Now, of course, it will happen sometimes, that however much we may wish to constitute

ourselves the handy man about the premises, ready at all times to mend windows, repair furniture, and so forth, we cannot squeeze a workshop out of any of the existing apartments of our house, though even here it may be said that where there is a will there is a way, for the writer of this paper has a friend who, being very mechanical, turned half his sanctum into a workshop rather than go without; here, was his writing-table, there, his lathe, in one corner, a bookshelf, in another, a small carpenter's bench; on one side, a tool cupboard, on another, the accessories of a study; and as he was a tidy workman the clean dirt of his dust and shavings did not interfere with the remainder of his surroundings. Such a state of things is seldom met with, though in another case, that of the writer himself, a somewhat similar plan was once adopted in a house in a street.

But such make-shift shops have, it cannot be denied, great disadvantages; the sound of the mallet and hammer is not sufficiently melodious to quickly ingratiate itself into the good wishes of the rest of the household, and it must be admitted that when the glue-pot boils over, as glue-pots will at times, boil we the glue never so gently, the result is not all that can be desired. Besides, dust is dust, and sawdust has its objections when found day after day by the careful housewife where dust ought not to be, and shavings, too, lose their beauty when they go dragging up and down stairs after busy skirts, and so indoor shops are certain, sooner or later, to get into disgrace, and probably our wisdom will shine more by their non-introduction than our patience will, afterwards, on their ignominious and peremptory eviction.

It is a disappointing thing to have a taste and be unable to gratify it, not that this is an uncommon state of things at all; but still this truth does at times press itself upon us rather sharply. If a man has a fancy for tools, his fingers are for ever in a state of discontent when he is not chipping or thumping something; but what is to be done if tools are forbidden fruit to him, owing to his surroundings?

There is one way out of his difficulty: he may build himself a shop in his garden or yard.

When we talk about building, a terrible vision usually presents itself to our mind—bricks, mortar, planks, hods, ropes, bricklayers, carpenters, painters, slaters, and their respective mates and assistants, all stand in nightmare array before us, and we banish the thought in a moment as too horrible. Well, AMATEUR WORK would soon lose half its adherents and readers if such suggestions were made, so we will not think of such things. But still we can only repeat that if a man must use tools he must have a workshop; and if he has not a workshop ready to hand, either indoors or out, then there is no other course open to him, and he must build. In these days very wonderful things are done with substances for which but a short time ago no such use could have been supposed possible; all the elements around us are pressed into our service, and when we do not over oppress them, that service is a willing one and a hearty.

Amongst the discoveries and inventions which are for ever coming to the front, are the new uses of paper; and perhaps the latest and not the least useful of all the suggestions made respecting it, is the aptitude with which it lends itself to take the place of wood and even sheet iron.

Last year I saw a building of which the walls and roof were actually formed of paper, and I found, on inquiry, that the paper proved very serviceable and durable: the paper was strong, easily manipulated, and cheap, so what more could be wanted?

I immediately thought what an excellent workshop could be erected by using it judiciously, no bricklayers and their satellites, no long bills, no troublesome delay. All we want is a little wood, a few nails, some rolls of paper, a few days' work at odd times, a handy man to help, the few tools we have indoors; and before our neighbours are aware, we shall have set up our workshop, and interfere no longer with anybody, and—what will perhaps appeal more strongly to our selfish human nature—no one will have any excuse for interfering with us and our hobby.

*(To be continued.)*

## A SELF-ACTING FOUNTAIN FOR THE TABLE.

By DONALD BEDE.



THE general principles underlying the construction of Self-Acting Fountains, as well as some simple designs for the same, were given at some length in Part 25 of AMATEUR WORK, so that it is unnecessary now to do more than give plain instructions for making up the present design. Fig. 1 is from a photograph of a table fountain and cut-flower holder; it was made of sheet zinc, and measured in height 18 inches, in width at top 8 inches, width of base or flower-tray 12 inches, and played a pretty jet of perfumed water for about twenty minutes at a time—being re-started in about half a minute—it is such an article that anyone capable of ordinary soldering, and of doing a little job in sheet metalwork, may undertake with every probability of success. The worker will require to get some No. 9 sheet zinc, and about 2 feet of  $\frac{3}{8}$  inch compo. pipe, and a small brass nozzle for the jet—commonly known as an “oil-can nozzle”—which can be purchased at almost any tool-shop. The zinc is sold in sheets 3 feet wide and 8 feet in length—one sheet will make nearly four fountains of the size here given, so that if the reader does not want to use much more than enough for one, he had better get a third of a sheet, costing, in London, about one shilling. “Strip” solder is the best to use for the job, as it can be “run” somewhat faster, and the amateur is more likely to make sound work with it, even if he uses more of it. The first thing to be done is to cut out the stuff—lay the sheet zinc on the bench and secure it by fastening it to the bench with a braawl, so as to be able to mark and cut it correctly. It will be seen from Fig. 1 that the sides, top and bottom are formed of a kind of fret, of which Fig. 2 is a full size pattern. There are three pieces of this wanted, one double (Fig. 2), and two single (Fig. 6); so from your sheet mark off a length of 24 inches by  $3\frac{1}{4}$  inches wide, for the top or double; next a length of  $25\frac{1}{2}$  inches by  $2\frac{3}{4}$  inches, for the bottom, and a length of 3 feet by  $1\frac{1}{2}$  inches for the flower-tray, both single fret. One circular



piece,  $11\frac{3}{4}$  inches diameter, for tray (Fig. 3), and one length of 26 inches by  $1\frac{1}{2}$  inches for centre of flower-tray, A.

Next cut a circle of 8 inches, one of  $7\frac{1}{2}$  inches, and two of 9 inches, and then a piece 15 inches long by  $1\frac{1}{2}$  inches wide, for the pillar, and, lastly, a small circle of 4 inches for the top cone, B, Fig. 5. Of course, these dimensions may be altered to any extent, they are simply given as the dimension of the one from which the photo was taken, if made larger, it will play longer; for instance, if the diameter of the top is made, when finished, inside 10 inches instead of 7 inches, as here given, and the bottom similarly enlarged, the fountain will play twice as long (about) owing to the fact that "the capacity of vessels increases much faster than their surfaces."

We have now everything cut out and can go right on with the work; but before doing so it will be as well for the amateur to see that he fully understands how the thing is going to work when finished, and why it will work. The principle, then, of this little fountain is "Hydro-pneumatic," *i.e.*, water and air-pressure. A column of water exerting its pressure in one vessel, transmits its power to another vessel by means of air, and forces the water from the second vessel to nearly as great a height as the column of water which caused the compression.

Now, if the diagram, Fig. 4, is carefully looked at, it will be seen that it consists of two air-tight vessels (except at their openings), which communicate with each other by pipes, and if water were poured into the basin, F, it would run down the centre pipe, B, into D, up the pipe, C, into the top vessel, until the mouth of the pipe, E, was covered, when no more could run in because the air could not escape, so that the two vessels can never be full at the same time—thus we have so much air and so much water; but we can easily fill the top vessel, F, by holding

the work upside down, when the water from D will then run down the pipe, C, the air of F escaping through E, and the atmosphere replacing the water in D through B.

Now, if we restore the work to its former position, we shall have F full of water and D full of air. If water is now poured into the basin, A, it can only run into the pipe, B, until full—unless the water escapes from the top vessel; so that what takes place is this, the pressure of the water in the pipe, B, compresses the air in D, which is communicated without loss of compression to the surface of the water in D, and tends to drive it out and above the jet pipe, E, to a similar height to that of the pipe, B. As this water falls back into the basin, the pressure down B is kept up until A becomes empty and D full of water.

This reversible action is very simple and convenient where a flower-tray is used, as any water that is spilled is caught therein; but even then, with an open top, this would cause a lot of mess and loss of water, so the writer contrived the cone piece, K, in Fig. 5, together with the concave top, and by reason of the bottom vessel being a trifle larger than the

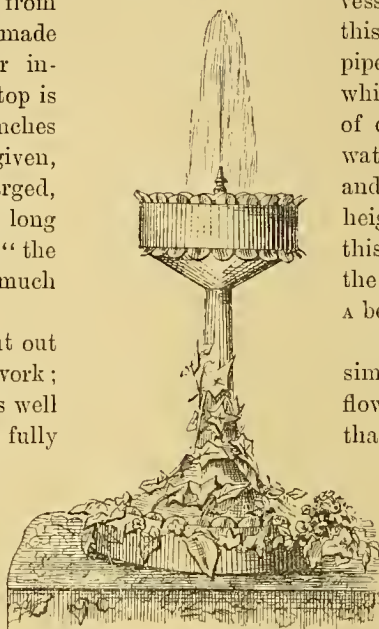


FIG. 1.—SELF-ACTING FOUNTAIN COMPLETE.

top, so that when the fountain stops playing, all the water runs down the centre and leaves the basin quite empty, then, when the fountain is reversed quickly, the hollow cone catches the water that would otherwise be spilled; it further serves the purpose of guarding the orifices of the pipe, B, and quite prevents anything going down likely to stop up the pipe.

Having now understood how the fountain works, the reader can proceed to make it up; the first thing to be done is to cut out the fret, take the length of zinc, 24 inches by  $3\frac{1}{4}$  inches, and mark off a straight line from both edges  $\frac{1}{2}$  inch from the outsides. Take a pair of dividers and mark half-circles on these lines (Fig. 6), all along, then punch holes on the

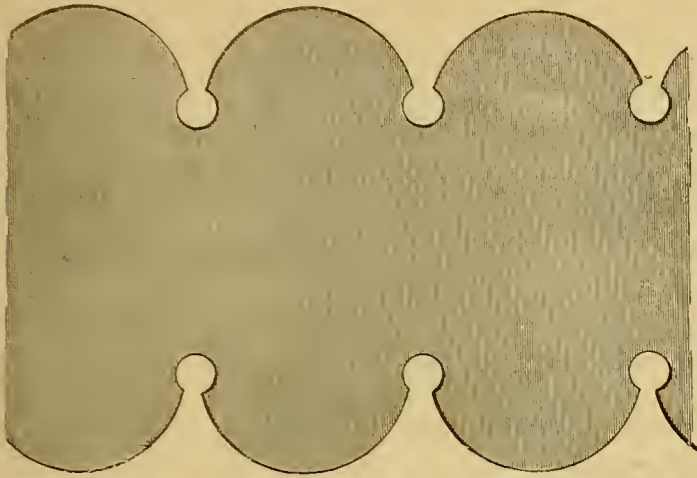


FIG. 2.

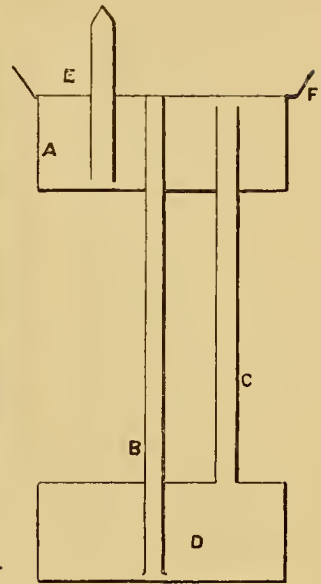


FIG. 4.

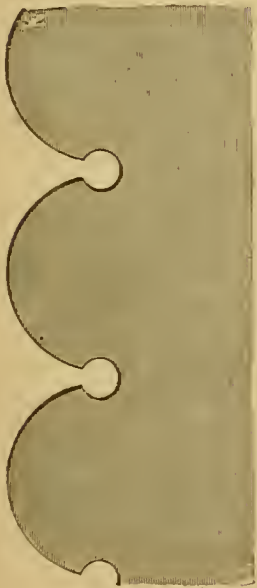


FIG. 6.

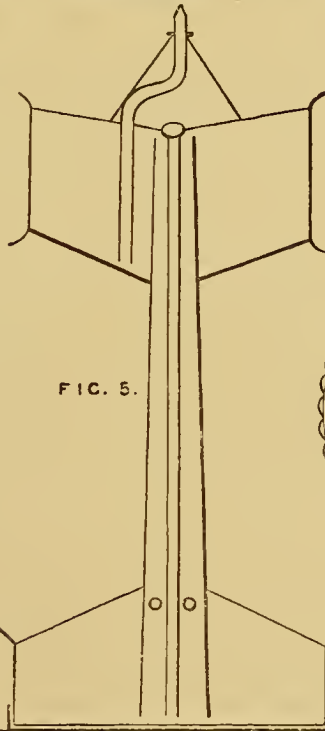


FIG. 5.

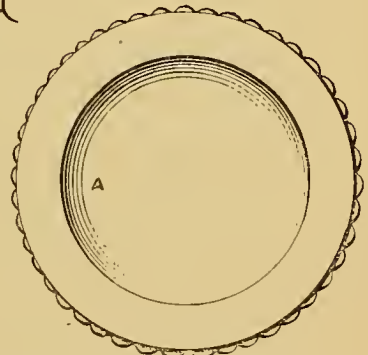


FIG. 3.

FIG. 2.—PATTERN OF ZINC FOR TOP PART OF FOUNTAIN, FULL SIZE. FIG. 3.—PLAN OF FLOWER-TRAY UNDER FOUNTAIN. FIG. 4.—DIAGRAM SHOWING PRINCIPLE UPON WHICH THE FOUNTAIN ACTS, NOT THE CONSTRUCTION. FIG. 5.—DIAGRAM SHOWING ACTUAL CONSTRUCTION OF FIG. 1, INTERIOR. FIG. 6.—PATTERN OF ZINC FOR BOTTOM OF FOUNTAIN, FULL SIZE.

points where the half-circles meet, file off the burr, and rimer the holes to about  $\frac{1}{4}$  inch, then cut with a pair of scissors the half-circles, as shown, Fig. 2; the other two pieces, the one for the bottom vessel and for edge of tray, will only require doing on one edge, as both their bases

are required to stand flat. Now take the piece to form the pillar, which, if no proper tool is handy, can be rolled round a piece of round wood—a ruler, or even a broom-handle—into a tubular form; it should taper a little, say,  $1\frac{1}{8}$  inches at top by  $1\frac{1}{2}$  inches at bottom, solder up sound

and file up clean, and true up the bottom edges so that it will stand up true. Now take your 8 inch circle, and solder to it the length of fret to form the bottom vessel, and afterwards tack the bottom of pillar to the centre of the circle, first "nicking" out a space to allow the water to run. Take one of the 9 inch circles, and cut it to form a cone to fit vessel and pillar. Make them a good fit before attempting to solder into position, and the job is much easier if you tack on three lugs, just below the holes of fret inside, so that the cone cannot fall in, solder up sound and see that the pillar is quite true and perpendicular; before the cone is fixed, a couple of holes should be roughly punched into the pillar, just under where the cone will be soldered—these are for air passages.

You can now try whether the work is air and water-tight, by filling it with water. Then take the  $7\frac{5}{8}$  inch circle, and make it into a slightly conical form to a diameter of about  $7\frac{1}{4}$  inches, and make a ring of the double fret to fit this. Solder it up sound, and take the remaining 9 inch circle and fit it to the underside, by making it conical with a hole to fit top of pillar, the positions are shown in Fig. 5, to which the amateur should carefully look as he proceeds. Before putting the top vessel on to the pillar, just snip two pieces out of the top of the latter, so that water will be able to run when the pillar is close up to its bearing, and when soldering together take particular care that the top and bottom are true together. You will require to solder in, at the centre of top, a length of  $\frac{3}{8}$  inch compo. pipe, reaching down the pillar to the bottom of the lower vessel; the lower end should be cut askew so that it does not come together with the bottom plate, and thus be stopped up, and should project as little as possible at the top. Cut a straight piece of zinc, narrow enough to pass down this tube to the bottom, leaving about  $\frac{1}{2}$  inch out at top. The object of this is to prevent the tube getting choked with air when it is being filled, as small tubes will frequently do.

Now take a 5 inch length of compo. for the jet pipe, and solder in, as shown in Fig. 5, and bend over so that the end comes central

with the top vessel; solder to this the small cone, so that it rests loosely on top plate, and make two vent holes near the lower edge with the point of a small bradawl. The female screw of "nozzle" must be soldered to the end of pipe, so that the jet is perfectly upright.

The work should now be tried to see if it is air-tight, by pouring water gently into the basin formed by the hollowed top, when it will run under the cone and down the pipe into the lower vessel; turn the fountain upside down, holding your finger over the jet hole, when, if there are any leaks, you will hear the hissing noise; these, of course, must be made good, until the whole is *perfectly air-tight*, or it will be of no use; assuming this to be done, the flower-tray may now be made, which will consist of the longer length of fret soldered round the large circle ( $11\frac{1}{2}$  inches) water-tight, with an inner circle of a band of zinc  $1\frac{1}{2}$  inches wide, to fit very loosely round the bottom of fountain, in fact, a good  $\frac{1}{8}$  inch all round should be allowed—this, also, to be water-tight—the pillar is to be festooned with ivy leaves, cut from the waste pieces of zinc with a pair of scissors; the leaves should be of various sizes, and may be copied from the natural leaves by holding the leaf under the thumb while cutting. A piece of wire should be soldered on to the pillar, about 4 inches from the top, and passed round two or three times spirally and soldered to the top of the bottom of fountain, two shorter pieces being added at about equal distances. The leaves should have stalks of galvanized iron tying-wire, and be soldered to the main wire to suit the taste of the worker, and painted the colour of natural leaves.

The fountain is now ready for painting, which is a matter of taste entirely. The writer prefers a tint which is a kind of French grey, with which any other colour readily harmonises. The fountain can be emptied entirely by attaching a piece of indiarubber tubing to the jet pipe (jet off), and thus forming a syphon, having previously held the fountain upside down to let the water run into the top.

The directions for use are simply these: To fill, pour water slowly into the basin at top until no more will run down, then take hold of the



fountain by the pillar, just under the top vessel, and hold the fountain upside down over a cup or small jug, jet being off, until water runs out of the jet hole, and about a teacupful has run out, restore the fountain quickly to its proper position, screw on the jet, and slowly pour into the basin the water which had run out, when the water will instantly rise from the jet hole and continue to play until exhausted, when it must be again inverted. Should the water not come, owing to being choked by air, it can be relieved by blowing down the jet hole.

In conclusion, let me say that this is a work which any intelligent amateur may commence with every certainty of success, and should any detail be not quite understood, the writer will be pleased to further explain it.

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## THE AMATEUR DEMONSTRATOR.

### LIGHT.

By OLIVER BECKERLEGGE.

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I.—THE OBJECT OF THESE PAPERS—WHAT IS LIGHT?—FULL DEFINITION IMPOSSIBLE—THEORIES OF LIGHT—EXPERIMENTS IN TRANSMISSION OF FORCE—SPEED OF LIGHT—THE LAW OF REFLECTION—EXPERIMENTS IN REFLECTION OF LIGHT—OPTICAL ILLUSION OF THE "TALKING HEAD."

**S**OMETIMES the amateur lecturer on physical sciences, whilst he has a clear knowledge of a fact, has not to hand a ready means of demonstrating it to another. Amongst the tens of thousands of readers of *AMATEUR WORK* there are, undoubtedly, numbers who, from time to time, like the writer, are called upon to talk Science to classes of young people. Again, there are others, whose children are frequently found asking questions, and an intelligent father is generally desirous of imparting useful information; but it is often the case that difficulty is experienced in making the thing plain by words to young, untrained minds, though, if an experiment could be performed, it would be the means of removing all difficulty. It is for the purpose of helping such that I commence a series of articles dealing with experimental physics.

It seems somewhat natural that light should

be first considered, and to this subject we will direct our attention. Now, although our object is experimental, we cannot proceed without some theoretical knowledge; and so we shall have to refer to theory more fully than we have generally done when addressing our readers heretofore.

Upon the very threshold of our subject the question comes, What is light? Will the reader be surprised if he be told that light cannot be defined—that is, fully? To define a thing is to limit and mark off the thing defined from every other thing—to differentiate it. But this involves much—indeed, a great deal more, than many think when they flippantly speak of a definition. It implies a complete knowledge of the thing discussed. It might not be difficult to define a cube or a straight line; but who can define "life," so as to place it as clearly before the mind as a cube? No one. And why? Because we know much less of "life" than we know of a cube. The truth is, we do not know *all* about life, hence the impossibility of differentiating it. Now, the same applies to the subject before us. We do not know all about light. We shall, therefore, have to content ourselves with a partial definition.

Light is that modification of force by which objects are made manifest to the organs of vision. In using the word "force," it is not to be understood in a loose or general sense, as an equivalent for impact or energy; but that imponderable, invisible, convertible *something*, which, under certain conditions, appears as heat, motion, electricity, and light—any one of which, under given circumstances, can be changed into the other.

There have been two different theories in relation to light. According to Newton, it is an emission of particles of luminous matter darting in straight lines from a given centre, which, entering the eye, produced the sensation denominated "vision." On this theory many of the phenomena, such as reflection and refraction, etc., can be accounted for. Yet, at the same time, it is open to such grave objections that, in the face of a better theory, must be considered fatal.

These supposed particles of matter must be

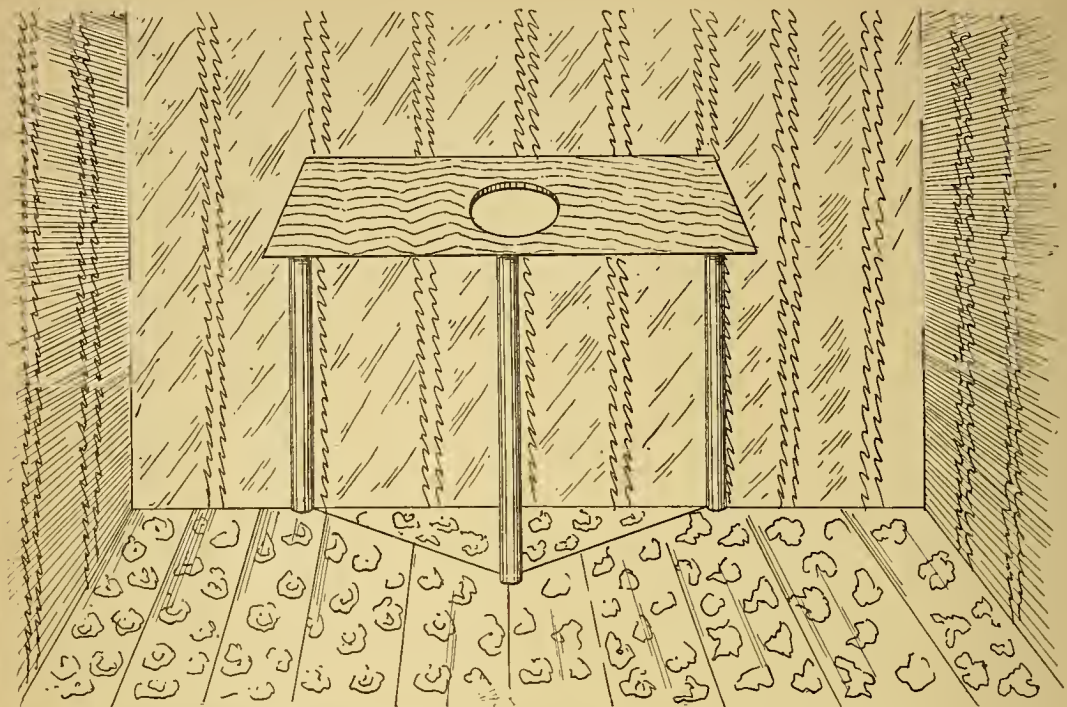


FIG. 7.—THE OPTICAL ILLUSION OF "THE TALKING HEAD."

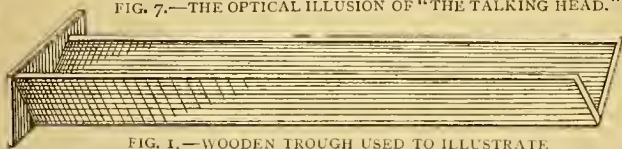


FIG. 1.—WOODEN TROUGH USED TO ILLUSTRATE TRANSMISSION OF FORCE.

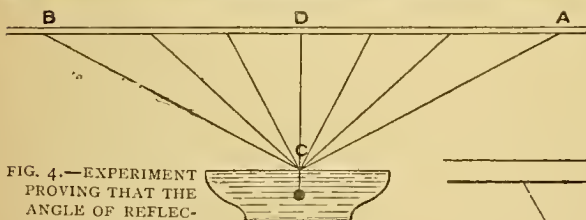


FIG. 4.—EXPERIMENT PROVING THAT THE ANGLE OF REFLECTION IS EQUAL TO THE ANGLE OF INCIDENCE.

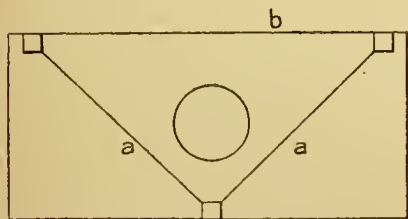


FIG. 6.—PLAN OF FIG. 7.

FIG. 3.—REFLECTION ILLUSTRATED BY THE ACTION OF A BILLIARD BALL.

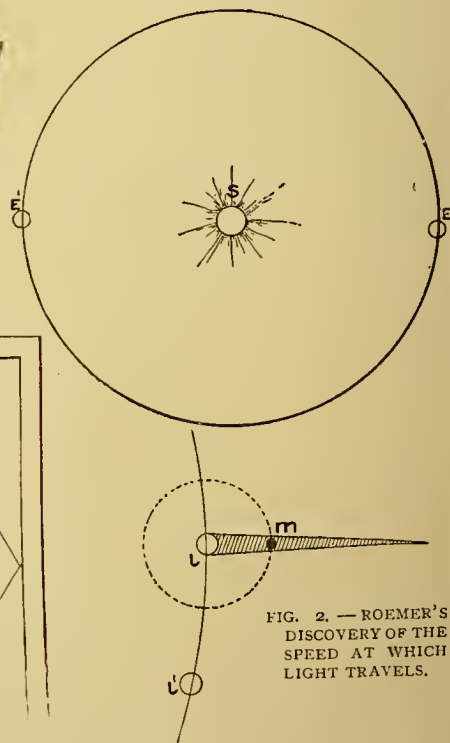


FIG. 2.—ROEMER'S DISCOVERY OF THE SPEED AT WHICH LIGHT TRAVELS.

of inconceivably small proportions, for matter attenuated even to atomic proportions, moving at the speed at which light travels, would be sufficient to destroy the eye. A portion of matter one grain in weight, moving with the velocity of light, would strike with an impact equal to a cannon shot of 150 lbs. moving at the rate of 1000 feet per second (Tyndal).

Again, millions of these supposed particles have been concentrated by means of lenses, and directed on a balance suspended by a single thread of a spider, without producing any deflection discoverable by any process of investigation—which result is not supposable if matter in any form actually impinged on the balance.

But, further, it is a fact well ascertained, that light, from whatever source it proceeds, travels at a uniform speed. Now, if light be projected matter, it must be subject to the laws of gravity, and its velocity would vary according to the density and mass of the source whence it proceeded. A stone or other matter projected from, or falling to, the moon, would move at a different rate to similar matter projected from, or falling to, the earth; the difference of velocity would be the difference between the mass of the moon and the earth. Therefore, this being so, and as light travels at a uniform rate, it is reasonable to infer that it is not projected matter.

The other theory of light is known as the undulatory, or wave theory. The celebrated astronomer, Huggens, was the first to oppose the emission theory, but it was left to Thomas Young and Augustine Fresnel to entirely overthrow it. All subsequent investigation of phenomena justify their conclusions, so that at present it is accepted by all philosophers as the true theory.

According to this, it is assumed that all space is filled with a form of matter known as ether—it is not a fluid or a gas, but partakes more of a

jelly-like nature. Under certain conditions this is made to vibrate, each molecule, if I may so say, strikes the next to it, and so onward; thus the motion is that of a wave, but not matter carried forward.

A pebble thrown into still water will cause a ring of waves to roll outward, but the water itself is not carried forward, so that a feather on its surface would have a vertical, but not a horizontal, movement.

A familiar illustration of this wave progression will be seen in a long line of railway carriages standing. Now, if another carriage moving, though but slowly, strikes the endmost one of the series, a wave of motion will be carried forward as each carriage strikes the next one to it and then recoils. You would observe that this wave travelled much more rapidly than the carriage which made the first impact. A very neat experiment may be made as follows: Two strips of wood, 3 inches wide and 4 ft. long, are joined together by their

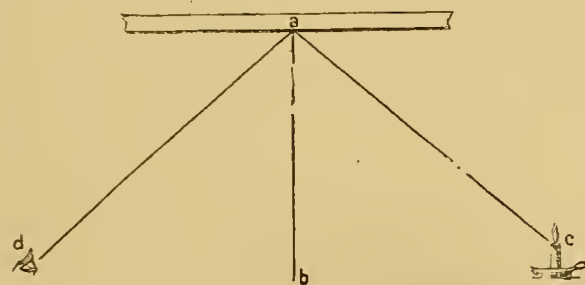


FIG. 5.—EXPERIMENT WITH CANDLE AND MIRROR, PROVING ANGLE OF REFLECTION EQUAL TO ANGLE OF INCIDENCE.

long edges so that the profile is V form. The inner sides of the wood must be planed true. If this is placed on a level table, a marble would run from end to end with little friction, Fig. 1.

In the groove place a dozen marbles in close contact. On striking one of the end ones motion is communicated through the whole series, as it would seem, instantaneously; and the ball at the other end is knocked outward at the same instant the blow was struck at the opposite end.

Now, what is the meaning of this? The blow compresses the elastic matter of the marble, which, instantly expanding, strikes its next neighbour, this contracting and again expanding strikes the next, and so on. This wave proceeds to the last marble, which, having no matter before it to which it can impart its motion, itself rolls forward.



In making the experiment, first of all roll a marble slowly along the groove and observe the time occupied in traversing its length. Then place a dozen marbles in contact, and roll one forward to strike the end one at the same speed as before, and it will be seen that whilst it takes an appreciable amount of time for the marble to traverse the groove, the wave of motion is apparently instantaneous; for as the ear hears the click, so the eye perceives the end marble to roll outward. We can now understand how a wave of motion can be transmitted more rapidly than matter can travel. According to this theory, light is the result of the vibration of an elastic ether—this pervades all space and penetrates, to a certain depth, all matter. Transparency is only a matter of degree. Gold is one of the densest of metals, yet in thin plates it will transmit light. Prepare a lantern slide by gilding it with leaf-gold, if now placed in a lantern as an ordinary slide a portion of light of a green colour will be transmitted.

Now, apart from the fact that by this theory all the phenomena of light can be accounted for, it has further to recommend it, that it is in accordance with the phenomena of sound. There is a wonderful parallelism between them, a few of which may be mentioned in passing, and to which reference will again be made. They are each waves of motion carried forward from an exciting centre, by an elastic medium. The pitch in sound and colour is according to the number of vibrations per second. The intensity or loudness is according to the length of the wave. They can each be reflected and refracted. Two distinct waves can be made to quench each other, so that the result will be darkness in one case and silence in the other. These points will be demonstrated experimentally as we go on. The greatest disparity between the two sets of phenomena being that whilst in sound the ear can grasp about eleven octaves, the eye can see under ordinary circumstances but one, though it is fair to say, that vibrations exist at each end of the spectrum, which, whilst under ordinary circumstances are invisible, yet can be rendered visible, so that the octave can really be somewhat extended.

In ancient times light was supposed to be transmitted instantaneously. This, however, is not the case. Nevertheless, its speed is enormous. This has been demonstrated in various ways. In 1675, Roemer, a Danish astronomer, was engaged in observing the eclipse of Jupiter's moons. He watched the moon nearest to the planet pass behind it and plunge into its shadow; the effect was as if a lamp had been suddenly extinguished. On emerging it was instantly rekindled. From the time it entered to immersing was forty-two hours, twenty-eight minutes, thirty-five seconds.

At the time Roemer made this observation the Earth happened to be in the part of its orbit nearest to Jupiter. About six months after he made another observation. Between these two observations the moon had been eclipsed one hundred times. Now, the time of the eclipse ought to be, of course, one hundred times forty-two hours, twenty-eight minutes, thirty-five seconds; but it did not come up to time: it was a quarter of an hour late. This brilliant thought occurred to him: that during the time that had elapsed since the first observation was made, he had been carried across the whole diameter of the Earth's orbit, and that the fifteen minutes represented the time occupied by the light in travelling across that abyss of more than one hundred and eighty millions of miles. If his reasoning were correct, then, he argued, that when the Earth gained the same relative position to Jupiter she occupied at first, the seeming error would be corrected, or that in her homeward race she would gain so much, on each eclipse, that by the time she arrived at her starting point they would be equal, the results justified his expectation.

Thus it has been demonstrated that light travels at the rate of one hundred and ninety-two thousand five hundred miles per second. The diagram, Fig. 2, will present this subject clearly to the eye: *s*, the Sun; *ε* and *ε'*, the Earth at opposite positions in its orbit; *♃*, Jupiter; *♄*, her moon in its orbit. In six months the Earth had travelled from *ε* to *ε'*, whilst Jupiter, travelling from *♃* to *♃'* was practically unchanged in its position. Thus the increase

in time was the increase in distance between the Earth and Jupiter, or the semidiameter of the Earth's orbit.

The phenomena with which persons are most familiar is that of Reflection. An echo is the reflection of sound, and reflected light is simply the echo of light. A familiar illustration of reflection is seen in the action of a billiard ball. If driven straight forward it will simply rebound and come toward its starting point, but if driven against the cushion at an angle, it will fly off in the opposite direction at an angle corresponding to the first. Knowing this, a skilful player can place the balls in what "pocket" he desires. Light obeys the same law expressed thus. The angle of reflection is equal to the angle of incidence, or, in other words, it rebounds at the same angle. Fig. 3 illustrates the path of a billiard ball.

To demonstrate this law, take a vessel of water and over it place a rod, as in Fig. 4; from the rod suspend a string with a weight attached, dipping into the water. Place a candle at *a*, move the eye along the rod until the reflected light rests where the line touches the water. If measurement be now made, it will be seen that the eye is exactly the same distance from the line on one side as the candle is on the other, showing that the angle between *b*, *c*, *D*, is the same as *A*, *C*, *D*.

Another experiment will prove the same law. Let *a*, Fig. 5, represent a mirror; at right angles to it draw a line, *b*; place a candle on the table at *c*. If the eye now be placed at *d*, the reflected light will appear at the point where the line, *b*, touches the glass.

It is by the operation of this law that when we look at a mirror objects appear behind the mirror as far as they are in front. By the same law marvellous optical illusions are presented, such as the talking head, ghosts, etc. As the first is a good demonstration of reflection to a class, I will describe it.

Fig. 6 is a plan; *a*, *a'*, are mirrors, set in a frame to resemble the legs of a table, and are placed at right angles to each other; *b* is a wall or screen. In the space between the mirrors and the wall the exhibit stands or sits. The wall

should be papered with a simple pattern, and the carpet on the floor should be small in pattern and dark. Standing in front, the wall and floor will be seen reflected, and will appear continuous right across behind the mirrors, and the mental impression will be that there is no mirror, but that we are seeing right back to the wall. In the table a hole is made for the exhibit to protrude his head, which will be seen, and nothing else. The illusion is made more complete by having a portrait of the head of the exhibit in wax, which may be shown to the audience. The exhibitor places the wax head over the hole in the table, which is received by the exhibit, who protrudes his own head instead, which now is instinct with life. It moves its eyes, opens its mouth, and, last of all, as though growing with consciousness, begins to talk, to the utter astonishment of the uninitiated, who fancy they can see under the table, and that the head they are listening to is the wax model they just now saw without a body. Fig. 7 shows a front elevation of the arrangement.

In our next article we shall show how light is reflected in various degrees under different circumstances.

## SAFETY BICYCLE CONSTRUCTION FOR AMATEUR MECHANICS.

By A. STEVENSON.

### VI.—THE HANDLE BAR—THE BRAKE—THE MUD-GUARD.

**U** E now come to consider the steering lever of our machine, commonly called the "handle bar." Handle bars for Safety Bicycles are made of hollow steel tube, of about No. 15, B.W.G. This tube is about 33 inches long,  $\frac{3}{4}$  inch diameter at the centre, and tapering at both ends to  $\frac{1}{2}$  inch or thereby. This bar, when purchased from the makers, is straight and roughly filed up. The first thing to be done is to fit the **T** piece, shown in last paper, in the centre of the bar (see **r**, Fig. 27). This **T** piece has got to be bored with a  $\frac{3}{4}$  inch drill; or, if already bored out roughly, it should be reamed to  $\frac{3}{4}$  inch, the reamer making a hole of uniform width throughout. This is often

attempted by amateurs, and even by blacksmiths, with a file; but a hole such as this can never be filed of a uniform width throughout, as it will be found, in spite of the most experienced handling, to be narrower in the middle than at the ends, consequently the bar will never be a good fit. If the amateur has not the means of boring out this and similar holes about the machine, he should get them done by a mechanic or engineer who has the tools suitable.

The handle bar should be filed at the centre, to fit neatly the T piece, where it may be left unbrazed until the bar is set (see A, B, Fig. 27). This is the form I usually give to the bar: the bends each taking up 3 inches of the bar and the centre of the bends,  $7\frac{1}{2}$  inches from the points, p, p. To bend the bar, heat about 4 inches at the parts A and B, one after the other, to nearly white heat, and bend gently over the horn of an anvil or other similar body, to an angle of about  $40^\circ$ . Having bent A, and cooled it, draw it down on a piece of board with pencil, then bend B till, on applying it to the drawing, it coincides. Care must be taken to see that the two ends are bent out of twist. By looking across, it will be readily seen if they lie in the same plane, or by laying the bent bar on a flat board. If there is any twist, one end will lie close on the board, while the other will be the amount of the twist from touching it. To take out the twist, heat the bend to red, and grip the bar in a vice, when it may be readily brought to the truth. The two ends should now be filed square across, and the holes in the ends, which will be about  $\frac{1}{4}$  inch, tapped for  $\frac{1}{4}$  inch snap-headed screws (shown in Fig. 27, A). These are screwed into the ends quite up to the head, their use, in conjunction with small washers, being to keep the horn handles from slipping off. The horn handles are about 4 inches long, bored out and polished when bought. They are shown in their place on the bar ends (Fig. 28). I cement them on with the same cement as for rubber tires. Having seen that they fit the bar, so that the tube comes just through, have the cement melted in a ladle; heat the bar end—not red, of course, but just as much as would make you let go if you caught it by mistake; put a little

of the cement in the hole of horn handle, then coat the heated metal for about 3 inches of its length; then work the handle on by pushing and turning it until the tube end just appears, when it is left to cool and set; then any superfluous cement is removed, and the washers and screws above referred to are screwed into their places.

These handles are, however, not cemented on, but only fitted, until after the handle bar has been nickel-plated; and nickel-plating cannot, of course, be done till the metal has been well filed up and polished, and, as before hinted, the better the finish and polish, the better will the plated job appear.

Before filing up the handle bar, the T piece has got to be set in its place, pinned, and brazed. The T piece must, first of all, be placed in the middle of the length of the straight part of the bar, then it must be set at a certain angle in relation to the bent ends (see Fig. 28, A). When the bent ends are in a level plane, as in the figure, the T piece inclines forward at an angle of about  $10^\circ$ . In this position it is pinned to the tube in the manner before-mentioned for other brazing joints.

The piece of tube, of a size to fit *inside* the steering-post tube, has now to be fitted to the tenon of the T piece, and also pinned; then the two joints are brazed together. In filing up brazed work, remove as much of the hard, rough scale as possible, with a *used* file, as it very soon knocks up a good one. In the absence of emery grinders and buff wheels, the amateur may have to do his work entirely with files and emery cloth; but even with these, and a fair stock of patience, he may make a very good job. After filing every part clean, taking care to leave no flat parts, lumps, or ridges, then, with a finer file, draw-file it—that is, take the file with both hands, and draw backwards and forwards, the length way of the surface being filed, turning the file so as never to make two strokes on the same place; then, with a very fine file, well rubbed with chalk, still draw-file every part as before. Now emery cloth can be used, three or four grades, using oil to finish with the finest, or flour grade.



Having disposed of the handle bar, we now turn our attention to the brake parts. The form of the brake lever is shown in Fig. 29, A being the edge, or vertical view, and B the side view, seen also in D, Fig. 30. The lever is

round to the front of the steering-post; also the brake lever, unless this part lying directly under the handle bar, and therefore following the same sweep. It is hinged to the handle bar some 5 inches from the centre of the T piece, a small

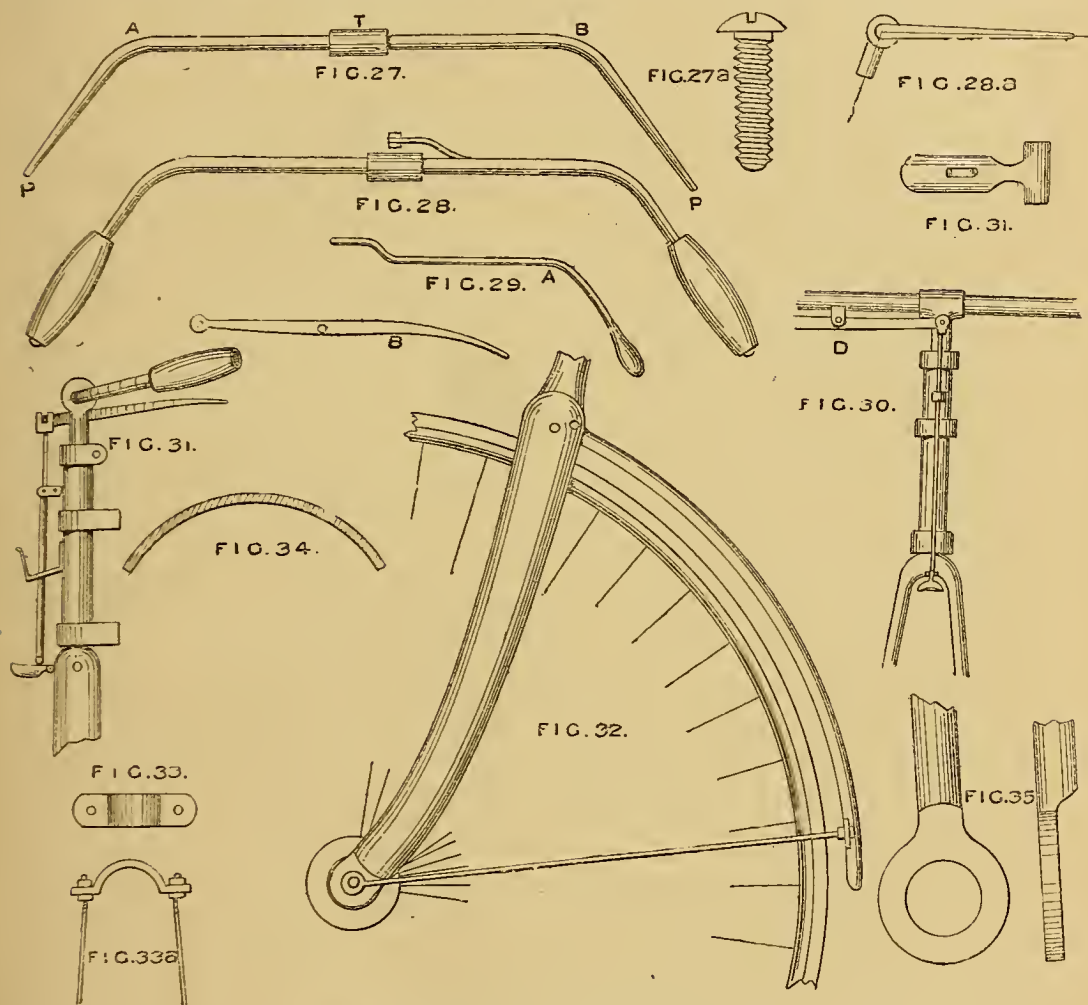


FIG. 27.—HANDLE BAR, BENT. FIG. 28.—HANDLE BAR WITH HANDLES ON. FIG. 29.—BRAKE LEVER. FIG. 30.—FRONT VIEW OF BRAKE WORK, ETC. FIG. 31.—SIDE VIEW OF FIG. 30. FIG. 31A.—SPOON BRAKE. FIG. 32.—SIDE VIEW OF FORK, WITH MUD-GUARD AND STAY RODS. FIG. 33.—MUD-GUARD CLAMP. FIG. 34.—SECTION OF MUD-GUARD, FULL SIZE. FIG. 35.—END OF STAY ROD, FULL SIZE.

made of solid steel, its broadest part, namely, where it is hinged to the handle bar, being somewhat less than 1 inch. It narrows towards the end, at the centre of handle bar, and the opposite, or gripping end, is flattened out to about 1 inch broad (see A, Fig. 29). The bending on the inner end is done to make it come

forked piece being brazed to the underside of the handle bar for that purpose (see D, Fig. 30).

The connection between the lever end and the spoon brake, which acts on the wheel, may be seen (Fig. 31), which is a side view of steering-post, handle bar, brake, etc. The connection consists of a bit of tube of about  $\frac{5}{16}$  inch internal

diameter, with a small forked piece fitted into the bottom to hinge with a small bolt to the top of the spoon. The upper end of the tube is fitted with a clutch ring similar to the top of the steering tube, which clutches, firmly, a small piston rod, so to speak, made to fit inside the tube, thus allowing the handle bar to be adjusted up or down in the tube, and allowing, also, for the adjustment of the spoon over the wheel. The small piston rod is forked at top, to attach to the end of brake lever by a small bolt or screwed pin. The spoon brake shown (Fig. 31, A), is hinged inside the crown of the fork by a pin passing right through; and the spoon should be at least half an inch clear of the rubber when out of action. In Fig. 31 is shown the lamp bracket, with the brake tube passing through a hole in it; it thus forms a sort of guide for the tube, and prevents rattling.

We have next to fit a mud-guard to this fork. Mud-guards can be bought to fit all sizes of wheels. They are made of thin steel, and curved in section, shown (Fig. 34) full size. The length of this mud-guard is about one-fourth the circumference of the wheel. It is attached to the fork inside the crown, and between it and the spoon brake, and there fixed by two small screws with flat heads, one on each side, passing through it, and screwing into the fork sides, a little behind the pin that hinges the spoon. Due care must be taken in fixing in the mud-guard, that it is made to lie evenly over the wheel in the whole of its length. It is kept in place by two stay-rods of  $\frac{1}{4}$  inch or  $\frac{5}{16}$  inch round steel wire, which pass from near its lower end forward to the end of the wheel axle on either side, where they are jammed between the nuts and fork sides. The length of these rods must be such that the mud-guard will be the same distance from the rubber of the wheel (about an inch) all round, from where it joins the fork to the bottom.

Fig. 33 A shows a clamp for attaching to mud-guard, which is a very good thing. It is a piece of  $\frac{1}{2}$  inch steel, bent to fit inside the mud-guard, and there riveted; the two ends are bored for the stay-rod ends to pass through. These ends being screwed, two nuts are used

for each, as shown in the figure. By this means the mud-guard may be nicely adjusted, both as to distance from the tire, and also to stand evenly over the centre of the tire. Fig. 33 A shows the edge of the clamp, and Fig. 33 the back. Fig. 35 shows face and edge; the inner ends of the stay-rods made to fit on to the ends of the axle pin.

(To be continued.)

## THE CYLINDER ELECTRICAL MACHINE.

By JNO. H. MILNE.

I.—HOW TO MAKE THE CYLINDER OUT OF A GLASS BOTTLE  
— CONSTRUCTION OF THE FRAME — MOUNTING THE CYLINDER.



IN the following article it is intended to show how, at a very trifling cost, any one may construct an Electrical Machine, which will be capable of performing the ordinary experiments usually given in text books on electricity.

Induction machines, such as the Holtz or Wimshurst, are greatly superior to frictional machines, but they are much dearer to buy and more difficult to construct.

The ordinary frictional plate machine, although simple in construction, will yet put the reader to an outlay of some few shillings, and will entail upon him considerably more trouble in construction than the one which we are about to describe, which in point of expense will cost only a few pence.

The cylindrical machine consists of three parts: 1. The Cylinder; 2. The Prime Conductor; 3. The Cushion or Rubber.

First, then, as regards the construction of the Cylinder.

Procure an ordinary glass bottle, quart size, about 11 inches long and 3 inches broad, such as usually contains beer or spirits. In choosing the bottle, try to get one of the same width of body from the neck downwards. Some bottles, it will be found, taper slightly from their upper to their lower extremity. These are less desirable than those whose bodies are of the same diameter, as the silk flap lies more evenly on the latter, and the rubber presses more equally.

Also endeavour to obtain as smooth a glass surface as possible, as some bottles of this class are much rougher and more uneven than others.

The next thing will be to make the axes. This can easily be done in either of the following ways :—

If the bottle is one in which the bottom is concave, and proceeds up the inside, leaving a considerable hollow in the bottom, cut out a circle from a piece of wood, measuring in thickness equal to the hollow in the bottle, make it fit as neatly as possible in the hollow, so that it will be flush with the edge of the bottle.

If the reader has not a lathe in which he can turn the wood to size, he can easily procure a piece of wood with the grain running across instead of along it. All he will then have to do will be to get a sharp chisel and cut it round to the required shape and dimensions, finishing by means of a rasp (Fig. 1).

Now glue the block into the bottom of the bottle. Carefully get the true centre, make a hole, and screw a wood-screw firmly into the wood to make one axis. The head should stand out about 1 inch.

Procure a piece of wood and rasp it round, so as to fit tightly in the neck of the bottle about three-fourths down so as to get a good hold.

Bore a hole with a gimlet right through the piece of wood, getting the centre, as the wood is, when put in position in the neck of the bottle. This is for the handle to be inserted in, so care must be taken to get the exact centre, otherwise the bottle will not revolve truly. Cut out a nick in the top about  $\frac{1}{2}$  inch broad. It will now be like Fig. 2, A being the wooden plug, and B the hole through its centre.

Now make the handle, and for the purpose procure a piece of iron rod  $\frac{1}{4}$  or  $\frac{5}{16}$  inch thick, and about 14 or 15 inches long. Bend it as in Fig. 3; then by means of a screw-plate, tap the wire between A and B, and make two nuts  $\frac{1}{2}$  inch diameter to fit tightly on. Also tap the handle end of the wire at C, and fit another nut so as to screw firmly on the end.

Now screw on the nut, B, as far as it will go. When it arrives at the point B, in the diagram, it will become firmly jammed. Put on the plug

which was made to fit the neck of the bottle, the nick will allow the nut, B, to fall into it: screw up the nut, A, firmly, when the wooden plug will be found to be tightly fixed to the rod.

Get a round piece of wood, a piece of broom handle will do very well, about 3 inches long, just long enough to act as a revolving handle. Bore a hole through the centre, put it on C, and screw on the nut, C, and the handle is finished. This kind of handle is much pleasanter to work than the plain rod handle.

The next thing to make is the frame. Get a piece of wood about 1 inch thick, 1 foot broad, and a little longer than the bottle. If the bottle is 11 inches long, say 13 inches. Cut out of the middle two nicks as in Fig. 4 A. Screw two upright pieces of wood into the nicks, one on each side, to act as supports for the bottle, about 2 inches broad, standing about 9 inches above the stand. Having fixed them nicely in position and screwed them up (Fig. 4 B), then by means of compasses, or in any other way, get a point about 6 inches from the stand. Now bore a hole sufficient to allow the iron of the handle to pass through easily, also a hole in the other support, A, B, Fig. 4 B.

Now the bottle must be mounted, and for this purpose bearings should be made. Get two pieces of brass, each about  $\frac{1}{2}$  inch broad, 1 inch long, and  $\frac{1}{16}$  inch thick. Bore a hole (a trifle larger than the thickness of the iron spindle, say,  $\frac{3}{8}$  inch) in the piece intended for the support of the iron handle end so as to allow it to just pass through. Make a hole above and below for screws to screw to support, with a small brace and bit or an Archimedean drill.

If the reader has not a variety of bits, he can easily make three small holes, and enlarge the centre one with a rimer, or handle end of a file—the pointed part which enters the wood. These bearings are to be screwed on the outside of the supports as at A and B (Fig. 4 B).

The best way to proceed is this. Take off the nut and revolving handle, then take the bottle with iron handle attached, put the handle through the support, then screw the brass bearing in its place on the support.

Having unscrewed the wood-screw from



bottom end of bottle, put it through the brass bearing and the other wooden support, and screw up tight in bottle; when the bottle revolves level and true, the second bearing can be finally screwed on to the support.

If the reader has carefully made the fittings, he will find the bottle will run very true, while the head of the wood-screw will be found of use in preventing lateral motion.

The movement of the bottle being found satisfactory it can be taken off, the plug glued in, the whole refixed, and the wooden handle put on. The cylinder is now complete.

A piece of wood should be screwed on the top of the supports A and B to strengthen them, standing about 1 inch above the bottle.

If the reader has not a screw-plate, he can make the handle bearings in a simpler but rougher way, by gluing a piece of wood in the neck of the bottle and boring a hole in the handle support of the proper size, then fixing a wooden handle to the projecting

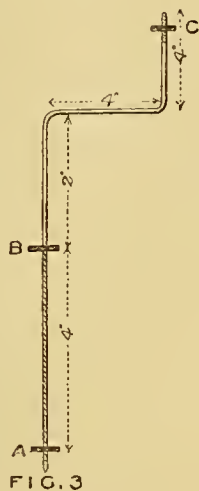


FIG. 3.

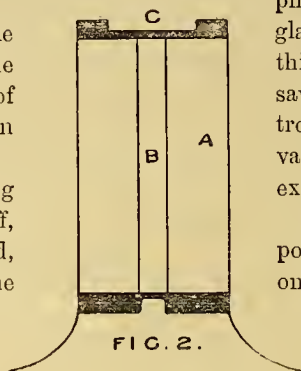


FIG. 2.

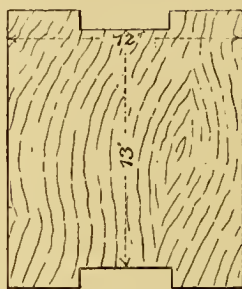


FIG. 4a.

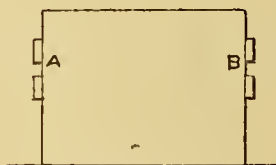


FIG. 4b.

FIG. 1.—a, WINE BOTTLE WITH HOLLOW IN BOTTOM; b, PLUG OF WOOD FITTING INTO a. FIG. 2.—PLUG OF WOOD FITTED IN NECK OF BOTTLE. FIG. 3.—IRON WIRE BENT AND TAPPED FOR HANDLE; A, B, AND C, NUTS. FIG. 4a.—BASEBOARD. FIG. 4b.—BEARINGS.

end. The other end revolving on a wood-screw simply screwed into the wooden bottom of the bottle as before, and working on the other support.

Or the reader can knock a hole in the bottom of the bottle (although he will probably break several in doing so), and put a wooden shaft like a ruler through, plugging it at the bottom end, as the hole will be irregular, and gluing at both ends.

In making the hole it will be better to make a small one by means of a strong sharp-pointed instrument, the strokes being sharp and decided, the hole can then be enlarged by means of pincers. For threepence, or so, a glazier might cut out a circle (although this is a difficult operation) and so save a great amount of unnecessary trouble. However, the first contrivance is the best and is very little extra trouble.

The bottle, being mounted in position, should turn evenly and truly on its axis.

(To be continued.)



DAMP WALLS.—This is what

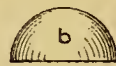


FIG. 1.

the *Cigar and Tobacco World* recommends its readers to use for preventing the damp striking through bricks:—"Boil two quarts of tar with two oz. of ordinary kitchen grease in an iron saucepan for about fifteen minutes. To this add some slaked lime and very finely-powdered glass; the proportions should be two

parts of the former to one of the latter. Mix the whole of the ingredients well together, and apply quickly to the surface of the wall, or it will become too hard. Of course, this may be afterwards either painted or papered over, as desirable."

INSTANTANEOUS CEMENT.—A solution of one part of amber in two parts of bisulphide of carbon forms a strong cement, which dries in a few minutes.

## A SIMPLE STOP-SHORT CHECK FOR GAS BRACKET COCKS.

By W. P. M. BLACK, B.L.

**Q**UANY of the readers of AMATEUR WORK have either a cellar or safe-room in connection with their business, into which they go probably several dozen times in the day, and in which they have to keep a gas jet burning to enable them to see what they are doing, which jet is turned up every time they go in and turned down every time they go out.

flame to be lowered to a very small size, a device has been invented called "The Matchless Burner;" but this contrivance has a good many drawbacks, which are likely to have prevented its adoption by many of my readers who have seen it, and who have experienced the need which it is intended to meet. It is a rather unsightly excrescence on the bracket; it necessitates the working of two cocks; and its price, though not great, is larger than the price of such a device, if intended to be widely adopted, ought to be. Something less bulky and obtrusive, more simple and less expensive is desirable; and that I have attempted to devise

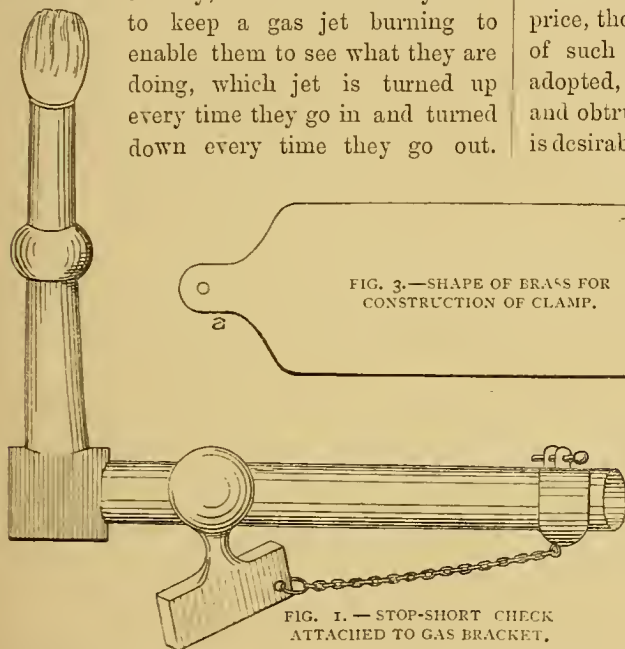


FIG. 1. — STOP-SHORT CHECK ATTACHED TO GAS BRACKET.

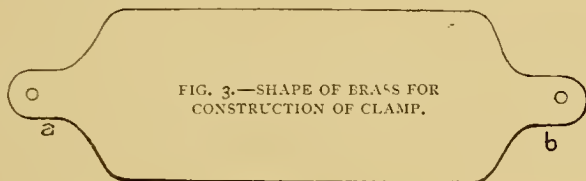


FIG. 3.—SHAPE OF BRASS FOR CONSTRUCTION OF CLAMP.

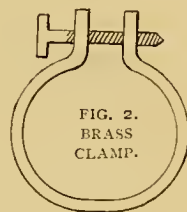


FIG. 2. BRASS CLAMP.

in the contrivance which it is the object of this paper to describe.

The device to which I have alluded is sketched in the accompanying engraving (Fig. 1). It consists, essentially, of a chain

having what watchmakers call a "hook"—that is, the spring-catch for attaching a chain to a watch—at one end of it, and a sheet brass clamp, a transverse section of which is shown separately at Fig. 2, for enabling the chain to be attached to the gas bracket.

Having procured two or three inches of fine chain, with a "hook" at the end of it, let the reader next provide himself with a small piece of sheet brass. Let this then be cut into the shape shown at Fig. 3, the length of the clamp, exclusive of the little nipples at each end, being made a little less than the circumference of the bracket which it is intended to encircle; tap two screw holes in it at *a* and *b*, and then bend it into the shape shown at Fig. 2. A small piece of brass wire must then be procured and converted into a screw for binding the clamp to the

Many other readers who have neither cellar, safe, nor perhaps even business, have in their houses rooms such as bath-rooms, where at least after dark, they like to keep a gas flame burning, which is frequently turned up and down a good deal in the course of the evening. Both these classes of people have no doubt frequently experienced the annoyance caused by accidentally putting out the gas, when it was only intended to lower it, thus necessitating a waste of time on the next occasion on which they wished to use the place, in searching for and striking matches, and perhaps in feeling for the bracket, to which they could easily have gone straight had the flame been in, however low it might have been.

To obviate this annoyance and loss of time, as well as to economize gas by permitting the

bracket. A screw from the gallery of an old gas bracket would suit admirably for this purpose.

The clamp having been completed, the plain end of the chain will next have to be soldered to the clamp. A small hole should then be drilled through the end of the handle of the cock, that is, next the wall when the gas is turned on. Through that hole a small ring should be inserted.

The chain should then be fixed on to the gas-bracket, about the position shown in the engraving, and the "hook" snapped on to the ring on the handle of the cock. The chain should be so adjusted, that when the cock is turned round to turn down the gas, it will be checked by the chain when the flame has reached the smallest "peep," which will stand the impact of a sudden gust of wind or draught without going out. That position can only be determined by experiment; but a few trials in shifting the clamp up and down the bracket will soon make it known.

When the contrivance has been properly adjusted, the reader will then be able to go to his cellar, safe-room, or other apartment, and having turned up his gas and accomplished his purpose, turn down the gas in as great a hurry as it is possible for him to be in without putting out the light. It will be seen from the sketch and description, that whether he turns the cock to right or to left, it will be checked at exactly the same point, and the gas prevented from being put out. By means of this device, which is simplicity and cheapness itself, and which can scarcely ever get out of order, or wear out in an ordinary lifetime, and which can be taken from one gas-bracket and applied in a few minutes to any other, the reader's time will be saved, his matches economized, and his temper kept sweet. Moreover, it will undoubtedly effect a saving in his gas bill, for though it does not permit of the gas being lowered to the smallest possible "peep"—as the Matchless Burner does—it will allow of its being lowered to a smaller size than in nine instances out of ten it would be likely otherwise to be.

When it is wished to turn out the gas for

the night, that operation is performed by first unfastening the "hook" from the little ring attached to the cock, and then turning the gas off in the ordinary way. The stop-short check can be put into working order again whenever wanted, by snapping the "hook" on to the ring again. The handy amateur workman will scarcely require to go outside his own workshop to procure the materials for making this device, if he is one of those people who are always putting past any odds and ends of materials that come in their way, on the chance that, as the proverb has it, if they keep them seven years they will find a use for them. To such the construction of the device will involve the expenditure of nothing more than an hour's labour—surely a very moderate price to pay for such a useful device. I had thought of endeavouring to devise means for making the contrivance a champion gas saver, but saw that it would unnecessarily complicate the device without giving any sufficiently satisfactory results in return. I may state, however, that my idea was to have a small cup-shaped piece of metal, pierced at the bottom with a hole of a little larger diameter than that of the burner, fixed, concave side uppermost, over the burner, and to connect this piece of metal with the rest of the device by some piece of mechanism that would elevate it, as the gas was lowered, until it surrounded the small flame and sheltered it from sudden gusts, and would slide it down the burner out of the way when the flame was turned up. Should any reader desire to add this to his "stop-short check" when he makes it, I do not think he will have much difficulty in devising mechanism for effecting the purpose to which I have alluded.

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FASTENING PAPER TO METAL.—The cheaper kinds of clock dials are printed on paper and then glued to a disc of zinc. It was found that in a short time metal and paper were apt to part company. The remedy for this was discovered to be quite simple. The zinc is dipped into a strong solution of washing soda, and afterwards rubbed over with onion juice. If the paper is then pasted on to this it is almost impossible to separate it from the zinc.



# HOW TO MAKE AN ELECTRO MOTOR FOR DRIVING SMALL MODELS.

By ELECTRON.

I.—TYPE OF ARMATURE—MATERIALS—COST OF CASTINGS  
—FITTING THE FIELD MAGNETS—THE ARMATURE AND  
SPINDLES—BEARINGS.



REQUEST having been made to the Editor of *AMATEUR WORK* for a description of an electro motor for driving small models, the following article is written in reply to that request:—

The motor about to be described is small and compact, its total weight, when complete, being about 2 lbs. The motor has field magnets of cast iron, the ends, or pole pieces, being widened and made hollow for the armature to revolve in; the armature is of the Siemens type, and is also of cast iron. The iron for these two portions of the motor must be very soft cast iron, and should be got from a foundry where this class of iron is used, as that in ordinary use is too hard. The bearings for spindles of armature are of brass, screwed to two projections, cast on field magnets. A commutator will also be required, and about five ounces of No. 20 cotton-covered wire.

Fig. 1 is a side view of field magnets, and Fig. 2 a plan view, looking down; the drawings are full size, so that any measurements may be taken from them.

The castings can be purchased for 2s. 6d., or patterns may be made from the drawings, and the castings made from them, bearing in mind what has previously been stated, that the iron must be very soft.

Having procured the castings, commence by fitting the field magnets, file the two feet level and square with the sides; this can be tested by setting it on a surface plate or other level surface, and trying the sides by means of a square; also, file the ends of the projections for bearings, making them parallel and square; also, file inside of hollowed ends square from sides of magnets, and make both ends one size, using a pair of inside calipers; cover the parts where wire is to be wound, as shown by dotted lines on Fig. 1, with tape glued on, and paint the

remaining parts, except inside of hollows, with enamel paint, to give it a neat appearance.

The armature must next be taken in hand; file one end square with sides, and fix it as near central as possible in a four-jawed chuck, or into a recess turned in a piece of wood screwed to face plate of lathe; turn the end true, and as much of the circular part as you can, making it  $\frac{1}{16}$  inch less diameter than the hollows in ends of field magnets. Drill a hole in centre of web or inside portion of armature,  $\frac{1}{8}$  inch in diameter and  $\frac{1}{2}$  inch deep; then reverse the armature, and turn the opposite end and the remainder of the circular part; also, drill a hole as before in centre of web. Two spindles must next be prepared for the armature to run on; they should be of mild steel,  $1\frac{1}{2}$  inches long, and  $\frac{3}{16}$  inch diameter at the largest part; turn down and screw one end to fit into the web; it should be a good tight fit, so that there is no fear of its unscrewing when running. Also, turn down and leave a shoulder at each outer end, where it passes through the bearings. Fig. 4 shows the spindles fitted to armature; also, the bearings, commutator, and driving pulley in position.

Having finished and fixed the spindles, the armature should be rotated between the centres of lathe, to see that it runs true; if not true, a little more must be taken off, using great care, for fear of bending the spindles. The commutator is made of a piece of dry boxwood, about  $\frac{3}{8}$  inch diameter, and a piece of brass tube driven on, and turned true (it will be better to turn this, and also the pulley on separate spindles, to prevent the risk of bending the armature spindles); the brass tube is fixed to the wood by two countersunk headed screws, which must not touch the spindles, or they will destroy the efficiency of the commutator; two slits must be sawn or filed with a fine file on opposite sides of the brass tube, cutting it into two halves. The slits are slightly on the angle, as shown in Fig. 4, to prevent sparking at the brushes. The commutator is fixed in position by Prout's Elastic Glue, or shellac varnish, the slits being opposite centre of channels in armature, as shown on Fig. 4. The commutator should be

soaked in melted paraffin wax before being fixed; the distance between the shoulders on the spindles of armature should be the same as the distance between the outer ends of the projecting pieces on field magnets, so that there is no end play when it is fixed in position, and they should be so arranged, that the armature does not project past either end of hollows in ends of field magnets.

The brass bearings should next be filed up; they are  $\frac{3}{8}$  inch wide, and  $\frac{3}{16}$  inch thick; drill a hole in the centre of each for the bearing, making it a good fit without any slackness; then fix the armature tightly into the hollowed ends of field magnets, by wrapping a strip of thick paper round the armature, put on the bearings, and mark on them the centres of projecting pieces on field magnets, and drill a hole  $\frac{1}{8}$  inch diameter in each; then, while the armature is fixed, mark through the holes drilled in bearings, the centres for holes in the projecting pieces

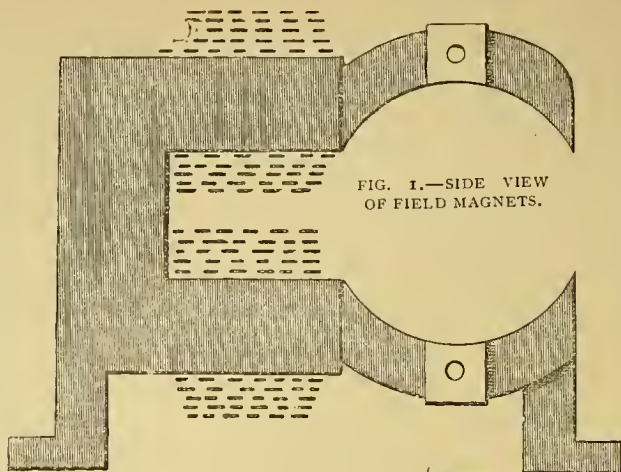


FIG. 1.—SIDE VIEW OF FIELD MAGNETS.

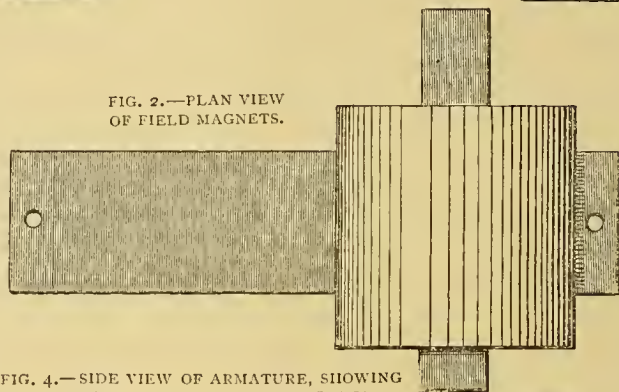


FIG. 2.—PLAN VIEW OF FIELD MAGNETS.

FIG. 4.—SIDE VIEW OF ARMATURE, SHOWING BEARINGS, PULLEY, AND COMMUTATOR

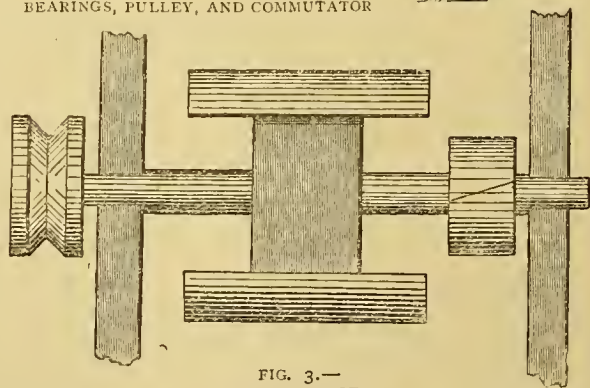
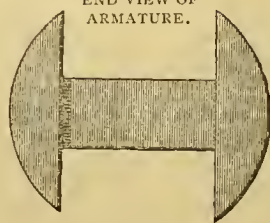


FIG. 3.—END VIEW OF ARMATURE.



on field magnets, and drill holes  $\frac{3}{8}$  inch deep and tap them to receive screws. The bearings can then be screwed into their places by screws  $\frac{1}{2}$  inch long. If the work has been accurately done, the armature, when thus fixed, should run easily, and without any shake. Should there be any stiffness, from the shoulders on spindles being longer than the inside of bearings, a little must be taken off them, or two liners of tin may be put under bearings to ease it; or if the shoulders be shorter, a thin washer of tin may be put on one end of spindles; the bearings should also be carefully screwed up, as sometimes a screw put in too tight will bind the spindle. In such a case, slack the screws

till the armature runs easily, and fix a liner under it.

A little care and attention exercised in this matter will not be thrown away, as much depends upon the easy and accurate running of the armature.

(To be continued.)



## NOTES ON NOVELTIES.

By THE EDITOR.

1. THE AMATEUR'S WORKSHOP. 2. LIST OF BICYCLE AND TRICYCLE FITTINGS. 3. HARGER BROTHERS' FRETWORK CATALOGUE AND PATTERNS. 4. "THE NEW GLUE." 5. "ENGLISH IDYLS."

1.  HE AMATEUR'S WORKSHOP. By the Author of "Pattern Making," etc. Published by Swan, Sonnenschien and Co., Paternoster Square, London. The title of this work is a slight misnomer; the nature of the contents would have been more clearly indicated by "Machinery and Tools for Amateurs," of which it treats exclusively. The first 189 pages are devoted to Machinery and the following 60 pages to tools, both sections being fully illustrated. The first chapter treats of the various motors (gas and steam) suitable for the requirements of an amateur, and hints are given for the proper management of same. I must join issue with the author when he omits the discussion of water motors on the ground that, as a rule, water power is unavailable. Most towns are now supplied with water under pressure sufficient to work a motor capable of driving light machinery. The succeeding chapters in the first part deal with Lathes, Chucks, Drilling Machines, Shapers and Planers, Circular and Band Saws, The Smithy, The Brass Foundry, Miscellaneous Appliances, and Shop Arrangements. The second part of the book is divided into three chapters:—Tools for Metal Working, Tools for Wood Working, and Tools for Measurement. Each subject is treated in a thoroughly practical manner, and evidently by one who knows what he is writing about. A highly commendable point about this author's works is that he never wastes any words, but gets as much information into a page as some writers will spread over two or three.

2. *List of Bicycle and Tricycle Fittings.* Mr. J. W. Dear, High Street, Baldock, Herts, sends me a little book containing a complete list of parts and accessories of Bicycles, Tricycles and Safeties, with the prices at which he supplies them. For all interested in these machines this is one of the handiest price lists that it is possible to have. Mr. Dear makes no charge for this list, and I would strongly recommend all Cyclists and those interested in the articles now appearing in AMATEUR WORK on the Construction of Safeties, to send for a copy; prospective builders of machines will thus be enabled to estimate the cost before commencing to build.

3. *Harger Brothers' Fretwork Catalogue and Patterns.*—Messrs. Harger Brothers, Settle, Yorkshire, send me their enlarged catalogue, specimen patterns, samples of hinges, fastenings, knobs, etc. This catalogue is probably one of the best "all-round" lists that an amateur can have, as, in addition to a very extended illustrated list of fretwork patterns, fittings, and every possible requisite for following that pursuit, the catalogue also contains a most useful list, extending over many pages, of handy tools, appliances, and cabinet fittings, such as an amateur is frequently in need of. Amongst these I notice lathes, chucks, engraving tools, gauges, carving tools, tracers, punches, etc., for repoussé

work; tool chests, new and improved tools, and a long list of cabinet fittings, and miscellaneous goods, nearly every item being illustrated. Amongst their fretwork patterns I must call attention to their two latest Books of Patterns, Nos. 8 and 9. The former contains designs for thirteen articles, amongst which brackets predominate. In the latter are fifteen designs for small ornamental and useful articles, as C. de V. frames, pipe rack, card trays, easel, handkerchief box, etc. Most of the patterns are good, and well drawn, and as the books are sold for one shilling each, the cost of each design is less than a penny. Nothing cheaper than this can be asked for or expected. Amongst the sheet patterns, No. 679 is an original and effective design for a calendar, with provision for marking, by means of movable hands or pointers, the month, day of month, and day of week. This pattern is priced at 1s. For anyone with courage to attempt and perseverance to accomplish an elaborate and useful piece of furniture, I can recommend No. 673, which consists of a series of designs forming a sideboard, with richly-designed panels and overlays in the Indian style of ornamentation. The extreme size of this very handsome piece of furniture is 4 feet wide, 4 feet 9 inches high, and 18 inches from front to back. The price of the set of patterns is 4s., and as most of the panel designs may be used for picture frames by using the border only, this charge is very moderate. For those who dislike the joiner's work necessary for the reception of the fretwork when cut, Messrs. Harger Brothers have made arrangements to supply the framing, and also the mirror required for the centre panel. A companion design to this, and in the same style of ornamentation, is No. 671, a bracket shelf, 15 inches by 13 inches, priced at 1s. Another design that attracts my fancy is No. 678, a top for a large-sized occasional table, so designed that it may be cut in sections and jointed up on a solid piece underneath. A good fretworker might inlay it with wood of a contrasting colour, and the effect would be very striking. I could mention many other good and effective patterns did space permit, but should advise my readers to get the catalogue and choose for themselves.

4. "*The New Glue.*"—This is a new liquid glue, a sample of which has been sent to me by The New Glue Company, Grange Yard, Valley Road, Shipley, Yorkshire. It has the appearance and smell of the old-fashioned liquid glue prepared by dissolving shellac in spirits of wine, and is said by the makers to be useful for joiners, cabinetmakers, boat, yacht, ship and canoe builders, and for fastening cycle tires. As a glue for woodwork generally I cannot recommend it, as I was unable to make a joint with it equal in strength to one made with good Scotch glue or Fish glue. Its dark colour is also a drawback, as well as the fact that it requires twelve hours to set. It might, probably, be found useful for the other purposes mentioned.

5. "*English Idyls.*" By P. H. Emerson. (Sampson Low and Co., Limited.) The author's note says:—"These Idyls or 'little pictures' have been drawn from life." They are, indeed, exquisite little word-pictures touched in by an artist's hand, and to read them is like taking a breath of country air after the fret and fever of a busy town. The author is evidently a student of men and manners, but he can take the common things of life and turn them into a poem.



## AMATEURS IN COUNCIL.

### I. INSTRUCTIONS TO CONTRIBUTORS AND CORRESPONDENTS.

1. Address Letters and Manuscripts to  
EDITOR OF AMATEUR WORK, Warwick House,  
Salisbury Square, London, E.C.
2. Write on one side only of the paper.
3. Illustrations or Diagrams should be  
drawn on a separate piece of paper, and  
not mixed up with the manuscript that  
they are intended to explain, or in which  
they are described.
4. When asking or answering questions,  
write every separate question and every  
separate reply on separate sheets of paper.  
Sign each with initials, nom-de-plume, or  
name and address, as preferred.
5. When replying to questions put forth  
under the heading INFORMATION SOUGHT,  
let the reply be headed, REPLY TO INFOR-  
MATION SOUGHT BY —, PAGE —, and then  
give the heading of the query as it appeared  
in AMATEUR WORK.
6. The EDITOR reserves to himself the  
right of refusing a reply to any question  
that may be frivolous, or inappropriate, or  
devoid of general interest. Replies to  
queries cannot be sent by post. Correspon-  
dents must bear in mind that their queries  
can be answered only in the pages of the  
Magazine, the information being supplied  
for the benefit of its readers generally, as  
well as for those who have a special in-  
terest in obtaining it.

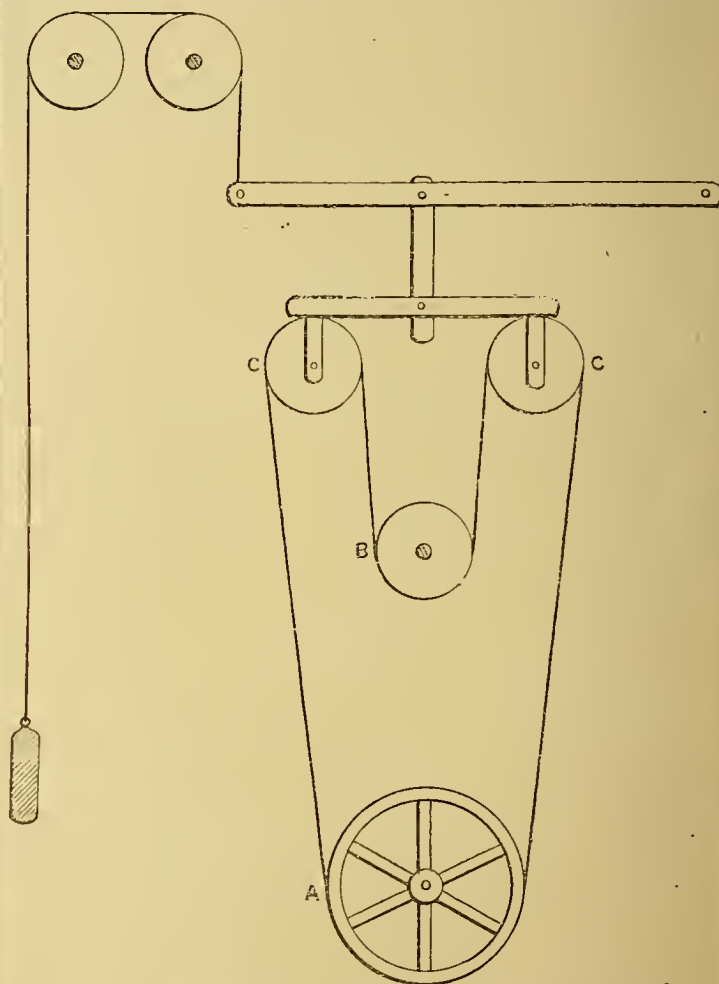
### II. AMATEUR WORK, SALE, PURCHASE, AND EXCHANGE NOTICES.

1. All Notices of Articles for Sale, Pur-  
chase, or Exchange sent to the EDITOR  
appear in the Coloured Advertising Pages of  
this Magazine. They must be prepaid, and  
accompanied with Penny Postage Stamps,  
as follows: For Twelve Words, or less than  
Twelve Words, 3d.; and for every additional  
Four Words, or less than Four Words, 1d.  
Names and Addresses to be paid for.
2. Advertisers who do not wish their  
names to appear can have their Advertisements  
inserted under a number.
3. Persons who reply to an Advertisement  
inserted under a number, must write direct  
to the Advertiser, and place the applica-  
tion in an envelope sealed down, with a  
PENNY STAMP attached in the upper right-  
hand corner, and the NUMBER of the  
Advertisement in the lower left-hand  
corner. Letters thus sealed, stamped, and  
numbered, must be enclosed to the EDITOR,  
who will write the necessary addresses on  
them and forward them through the Post  
to the persons for whom they are intended.
4. Every Single Article (unless the Ar-  
ticles advertised are of the same kind or  
nature: as Books, Tools, Organ Materials,  
etc.) must form the Subject of a Separate  
Advertisement.
5. No Trade Advertisements can be in-  
serted in this Department, which is open  
to bona fide Amateurs only.

### An Easier Method of Tightening Lathe Bands.

C. J. WOLFE writes:—"I was very much pleased with ELECTRON's plan for tightening lathe bands, but I think the following will be found an improvement. In ELECTRON's plan both the bands must be equally taut, and if one stretches more than the other it must

author of 'My Lathes, and How I Made Them,' supposes a novice, who has the dead-centre lathe fitted up, to be able to turn steel without knowing anything about it. As a matter of fact, every turner should commence with wood and then proceed to metal. I have made a lathe from these instructions, and have found them very easy to follow. My



AN EASIER METHOD OF TIGHTENING LATHE BANDS.

be adjusted; but in my sketch, which explains itself, there is only one continuous band, and instead of two separate pulleys side by side, Fig. 1, c, they are apart. By this means uniform tension is secured."

#### Lathe-making and Metal-turning.

C. J. WOLFE writes:—"I beg to make the following suggestion: that a competent writer should give us a few hints as to metal-turning and its tools. The

wheel, 80 lbs., with two flat-turned speeds, and crank shaft, 4 feet 6 inches, with double cranks and brasses fitted, cost 25s. 6d., at Robt. Bobcy's, Engineering and Implement Works, Bury St. Edmunds, where you can procure castings in iron and brass, and got work turned in first-class style. The prices, also, are moderate, about two shillings an hour for turner's work. My mandrel pulley I made of three pieces of  $1\frac{1}{2}$  inch

oak, screwed and glued together, with the centre piece cross-grained to the other two. This makes a very strong job. Apologizing for taking up so much space." [Pray do not apologize for taking up space with interesting matter. I am pleased to hear of your success in lathe-making. I have already arranged for a series on Metal-turning, but cannot promise it at an early date, as so many other subjects are already promised.—Ed.]

#### Preservative for Leather.

D. W. B. (*Liverpool*) writes:—"Could you tell me of any preparation which, if rubbed on the uppers of new boots, will tend to keep them soft and make them last longer than they otherwise would?" I can tell you what I use myself, and although I would not venture to say that it is "the best," I have never yet found anything to equal it. Melt together, with heat, equal parts of castor oil and pure mutton fat: apply this to the leather in front of the fire, and rub it well in with a piece of rag. I can also give you another hint from experience in the care of boots: if the leather becomes soaked with wet, as it will do after being out in deep snow, instead of putting the boots in front of a fire to dry (which is the worst thing you can do), fill them up to the tops with dry oats. The grain absorbs the wet out of the leather and, as it becomes moist, swells and fills the boots tightly as if on a last, thus preventing the leather from shrinking. The oats may be dried and used again and again.

#### Shutting off Staircase.

NORMAN.—You do not say how your staircase is lighted, but as you are now using a curtain, I presume the light coming down the staircase is not required for lighting the landing. If this is so, you might put up a light panelled framework, treating the panels in an artistic manner. The top panels, which should be shorter than the others, might be filled with Japanese lattice work, in which case a little light would find its way through; or these top panels might be filled with stained glass. If you use the transparent wire wove roofing (of course, fitted into a wooden framework), you may improve its appearance very much by decorating the panels with paintings. I have seen some very artistic screens made in this way.

#### Sash-making.

JOHN DORE.—All things come to the man who waits, and you have

certainly waited patiently for this article. The papers I have in hand treat the subject very exhaustively, and will take up much space, it has, therefore, been difficult to find room for them while so many other matters demanded attention, but the reward of your patience will not be much longer delayed.

#### Organ Building.

R. C. H.—I have sent your letter on to ORGAN BUILDER, asking him to give you the information asked for in your letter. I will publish his reply next month.

#### Material between Boarding and Slates on Roof of Shed.

NORMAN.—After nailing the boarding on the rafters, cover it with roofing felt nailed on with zinc or copper nails: then put on the slates. Willesden paper may be used instead of felt, if desired.

#### Electric Alarms.

HERBERT WEST.—A member of my staff has taken this matter in hand for you, and the article shall appear at the earliest opportunity.

#### "Example is Better than Precept."

F. RAYNER writes:—"My object in writing is because I think you will be pleased to hear I have again been successful in securing three new subscribers by lending a vol., and letting it speak for itself. I am delighted the Second Series are proving as interesting and instructive as the first, and trust it will so continue. Wishing you every success." [I am very much pleased, and hope other readers will follow your example.—Ed.]

#### Carbon Transmitter.

F. R. S. (*London*).—You will find the article on this subject on page 142, Vol. IV.; otherwise Part 39, Old Series.

#### Organ Blower.

TUBA.—I sent your inquiry on to Mr. Mark Wicks, who replies:—"I regret that it is not now within my power to give a sketch and description for a machine to blow an organ by means of a falling weight. Perhaps some other contributor can assist you."

#### An Easy Method of Truing Oilstones.

NIGGER (*Croydon*) writes:—"I am sure there are many find as I did how soon an oilstone gets out of truth, and do not know how to remedy the evil. Some time ago I hit on an idea, which I will give, thinking it might be useful to others. My scullery floor is concrete. I found a fairly level part, then

I sprinkled a little emery (No. 1) down, and rubbed stone on it; in a short time I found it nice and level, and ever since I have been able to keep my stones true."

#### Arts and Crafts Exhibition.

B. writes:—"Why did you not tell your readers and subscribers where the Arts and Crafts Exhibition Society's exhibition was to be held? It might be held in London, Birmingham, or five hundred other places: we are not supposed to know by intuition. P.S.—I am obliged to spend 3d. in a post card to Mr. Radford." [So it might, B., but, as a matter of fact, it is now being held at *The New Gallery, 121, Regent Street, London, W.* I hasten to add this information, which by some incomprehensible means was omitted from the notice, lest any other readers should be led into the same reckless extravagance that you have been guilty of. The pathos of that P.S., dear B., has touched me to the heart. Send on your address and you shall have the cost of that post card, though it ruins me.—Ed.]

#### Model Cutter Yacht.

JOSEPHUS writes:—"Many thanks for H. Berry's kind offer, but the one I intend building is a 10-ton cutter yacht, for racing purposes."

#### Autocopyist.

A. W. B. (*York*) writes:—"As I think it may be of some use to your readers, I beg to forward you my experience of the 'Autocopyist,' which was described in a recent number of AMATEUR WORK. I have taken some few thousands of copies from this machine during the time it has been in our office, and I may say it has never failed to produce good work when it has been prepared according to the directions. I always use cold water to steep the parchment skin, as I find that warm causes the gelatine to become too soft. Ordinary printers' ink will do to ink the impression on the parchment. We always use it, and find that it is as good if not better, than the ink sold in tubes specially for the purpose. In writing the original with the special ink use a fine pen, and write as thinly as possible. The apparatus and accessories can be purchased at the 'Autocopyist' Depot, Americo-European Trading Company, Limited, 8, *Albert Building, Preeson's Row, Liverpool*. I consider this machine to be superior to any other copying machine yet invented. There is, practically, no limit to the number of copies which may be taken off one impression."



**Boiler-making and Gas Engines.**

**SUBSCRIBER FROM THE FIRST** writes:—"Surely there would be little difficulty in getting someone to write the article for a consideration. Being a matter of such importance to many amateurs it should not be treated as 'finding space' for someone who wants to rush into print, but rather of procuring an article to meet the wishes of subscribers. I may say that I think *AMATEUR WORK* splendid, and shall continue to buy it as long as it and I exist." [I am equally obliged to you for your stricture and your praise: I like my readers to speak out their minds without fear or favour. To take the praise first—the jam before the physic—I trust you may live to a ripe old age to enjoy your *AMATEUR WORK*. I will not wish you may live as long as *AMATEUR WORK*, because, if you remember, the "Wandering Jew," who was cursed with perpetual life, found it rather a bore than otherwise. Now for the physic: all articles appearing in these pages are written "for a consideration," and no one "rushes into print" in *AMATEUR WORK* unless he knows what he is writing about and can come up to the required standard. I have engaged the services of a practical boiler-maker to write a few papers on the construction of small boilers from  $\frac{1}{2}$  to 1 h.-p., but I cannot, at present, say when space can be found for them, so many subjects are claiming attention; in the meantime, rest assured that neither you nor anyone requiring information will, in the long run, be forgotten. As to articles on the construction of a gas engine, you are, doubtless, aware that this is difficult work for amateurs, and could be undertaken only by those who have acquired considerable skill, nevertheless, if I receive sufficient demands for such papers to show that they are likely to be generally acceptable, they shall be produced.—**ED.]**

**Wood Carving.**

**NEMO** writes:—"Could you recommend me a text book on Wood Carving? I have seen one by Mr. Bemrose, published by Bemrose and Sons, but the instructions appear, to me, to be very scant considering the price of the book (5s.). I should be glad to know what firm supply patterns for wood carving, suitable for a beginner; also the price of same." [I presume you want models as well as designs so that you may have the actual work to guide you. You can get this by applying to Mr. G. A. Rogers, The Studio of Wood Carving, 29, Maddox Street, London, W.

He has a large selection of beautifully drawn designs, carefully shaded, which he supplies at from 1s. to 3s. per sheet. All that I have seen are highly artistic and well worth studying. Mr. Rogers has carved many of his designs for the purpose of lending them to copy, and these carvings are let out at a small monthly hiring fee. If you have already acquired the rudiments of wood carving, the assistance of having a good model to work from will be almost equal to personal instruction. Mr. Rogers is also the author of "The Art of Wood Carving," price 1s.; or, bound in cloth, with numerous illustrations, 2s. 6d.—**ED.]**

**Solid Drawn Tube.**

**L. M.** writes:—"I wish to make a number of lengths of solid drawn copper tube,  $\frac{1}{2}$  in. internal diameter and  $\frac{3}{8}$  in. outside diameter, and shall feel obliged if anybody will give a description of the necessary tools."

I hardly know how to advise you. The tools and appliances required would mean a somewhat large and costly plant, and you can buy what copper pipe you require for the merest fraction of cost in comparison with this. The only method which you can possibly employ is that of draw-plates encircling the tube, and triplets or mandrels within it. Through these the copper would be drawn by gearing sufficiently powerful, the pipe being passed through plates of diminishing diameters until the final one was reached. For drawings see Holtzapffel's "Turning and Mechanical Manipulation," Vol. I., page 429; Tomlinson's "Encyclopædia," Article, "Tubes and Pipes;" and Knight's "Dictionary of Mechanics," Article, "Tube."

—**J. H.**

**Emery Wheels for Grinding Razors.**

**ED. J. SMITH** writes:—"My own experience has been so different from yours that I am impelled to send you a line or two on the above. In 1880 I purchased an 8 inch by 1 inch emery wheel, from Mitchell's Emery Wheel Co., stating at the time that I wanted it for grinding hardened steel lathe tools, etc., and after a little experimenting I hit on a dodge for mounting the same, whereby I can easily obtain 2000 or more revolutions per minute, and it has answered so well that I would not do without it for a great deal. My success I attribute to (1), leaving the quality and grade of wheel to the judgment of the makers, merely telling them what I wanted it for. (2), Going to an eminent firm of great experience, and who have a good reputation to lose, like Mitchell's Emery Wheel Co., of Mill St.,

Bradford, Manchester, certainly have. (3), To my running the wheel sufficiently quickly, and though I have had the wheel so many years and have not spared it, it now measures  $6\frac{1}{2}$  inches in diameter. I can use it wet or dry; it never glazes, and emits no smell. At first I used it principally dry, keeping my finger on that which I was grinding, and when getting a little warm dipped the tool in some cold water which I kept at hand for the purpose. Now I moisten the wheel with a sponge held in my left hand, and find I can grind a thin  $\frac{3}{4}$  in. chisel without fear of drawing the temper. When first made there is a skin on the emery wheels, which will not cut at all, and it is necessary to remove this by grinding the wheel on a paving or other flat stone with sand and water or taking a cut over it when running in its bearings at about 80 ft. per minute with a diamond—this may cause your failure, or, unless you have some special contrivance, you do not probably get speed enough, or, perhaps, your wheel is not suited for the work you tried it on. Mitchell's wheels are sent out turned true on the periphery and on the faces, if desired. I enclose Messrs. Mitchell's catalogue, from which you will notice that they are now making a very handy little tool for amateurs, fitted with 9 inch by 1 inch emery wheel, flywheel, treadle, and stand, all complete for the very moderate sum of 35s., including steel shaft running in extra long bearing, and turned and balanced wheel." [The list received is a very useful one, and I am much obliged to you for sending it.—**ED.]**

**INFORMATION SOUGHT.****Removing Enamel from Binding of Book.**

**D. W. B. (Liverpool)** writes:—"I began taking in *AMATEUR WORK* last December, and was so pleased with it that I made up my mind to get all the back volumes by degrees. I have now got Vol. I. (Old Series), bound in half-calf, which makes a useful and handsome binding. Some enamel has got on this binding, and if anyone can tell me how to remove it without damaging cover I will be very much indebted to them. I have got one friend who is going to start to take in your publication at the beginning of the volume." [Many thanks.—**ED.]**

**LETTERS RECEIVED UP TO NOV. 11.**

**F. H. IVESON**; **L. F. P.**; **ADAM MENZIES**; **H. W. D.**; **AMATEUR**; **J. T. NISBETT**; **CYCLIST**; **R. C. H.**; **A. W. B.**; **BELLSHAW**; **A SUBSCRIBER FROM THE COMMENCEMENT OF "A. W."**





# DESIGNS FOR "WOOD CARVING" By "Rouge Dragon"

For descriptive text see page 53.



FIG 6 Panel from old oak pulpit.



FIG 2 Tudor rose design for shield



FIG 3. Tudor rose design for border



FIG 4. Round top for stool, quarter of design.



FIG 1. Panel from old oak cabinet.



FIG 5 Border from oak cabinet





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# AN ORNAMENTAL AND USEFUL PAPER-KNIFE.

By R. W. C.

**PAPER-KNIFE** is an article which is frequently needed both in the library and in the sitting-room. One or more of them, of an ornamental form, placed upon a side table, add an effective appearance to the furniture of a room, and meet with frequent approbation from those who are readers of large newspapers and magazines which need "cutting,"

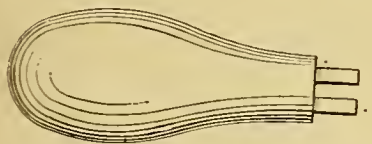


FIG. 1.—HANDLE OF KNIFE, PLAIN TURNED.

before they can be conveniently read. I will now proceed to describe an ornamental form of knife, which consists partly of turned work and partly of fretwork.

The paper-knife consists of two parts—the knife and the handle, the latter of which we will describe first. Chuck on the lathe a piece of wood, of any kind that you please, about 8 in. long and  $1\frac{1}{2}$  inches or more in diameter. Turn one end of this perfectly flat, and cut away the wood for about an inch until you have formed a

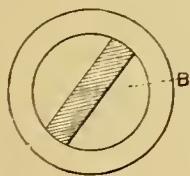


FIG. 2.—SECTION OF HANDLE AT FERRULE, B, FIG. 4.

projecting collar, as is represented in Fig. 1, and ornament the rest of it as you please. Polish with French polish and remove from the lathe. Then, down the middle of the end which you have formed into a collar, cut a slit slightly less than a  $\frac{1}{4}$  inch wide. Next, form on your lathe a wooden ferrule, and turn it so that it will fit

tightly on to the collar which you have made on the handle of the knife. This ferrule may be made of the same wood of which you made the handle, or of any other wood which will match it nicely. It should be made of the same diameter as the handle, and should be slightly



FIG. 4.—BLADE FIXED IN HANDLE.

longer. When you have finished turning the ferrule, polish it, and glue it firmly on to the collar.

We have now made all the essential parts of the handle, which may be made as large or small as you please, from 2 or 3 inches in length to 8 or 9 inches, or even longer. If you wish to make a very elaborate paper-knife, the handle may be fluted or otherwise ornamented by the overhead apparatus. In that case it must be made of ivory, boxwood, or some other hard material. A very effective appearance is



FIG. 3.—SHAPE OF BLADE.

obtained by inlaying the handle with small spots. This is done by boring small holes in a circle round the handle, before you have finished turning it, at equal distances apart, and gluing into them small plugs of wood, which you have previously turned, of the same size as the drill which you used for boring the holes. When the glue is dry, file off the projecting ends of the plugs, and then, finally, finish them off flat, or otherwise, by turning the whole handle on the lathe. Several of these circles of holes may be bored at various distances along the handle, and they must be filled with plugs made of some kind of wood which contrasts agreeably with that which you used for the handle.

When you have finished the handle, and have glued the ferrule on to it, the end of the handle will have the appearance of Fig. 2, there being a slit in the middle part of it, indicated by the shaded part, *B*, into which the shank of the blade, to which we will now turn our attention, is intended to fit.

This is made of wood, about  $\frac{1}{4}$  inch thick, which may be either walnut, rosewood, holly, or mahogany. Walnut is the wood which I have generally used, because it may be easily formed into a sharp knife by means of a file. Having selected the kind of wood which you intend to use, plane a piece of it the required length, and cut it with a fretsaw into something like the shape represented in Fig. 3, which is in the form of a scimitar, and plane the end of it carefully so that it will fit neatly into the slit which you have prepared for its reception at one end of the handle. Now, with a file or a plane, I think a moderately coarse file answers best, file away wood on both sides of the lower edge of the knife, from the shank to the extremity of the other end, until you have made an edge which is sharp enough to cut paper. When you have done this, finish the knife off with sand-paper, and either polish, or leave plain, according to taste, and glue it into the slit in the handle with strong glue. Fig. 4 shows the three pieces of the whole paper-knife fitted together. The handle is represented by *A*, the ferrule by *B*, and the blade by *C*, which shows only its lower edge. The blade need not be as plain as is represented in Fig. 3. The upper edge and the interior may be ornamented by fretwork, and the holes so made may be either left open or filled up, thus forming inlaid work. If the whole paper-knife is to be made very small, both the knife and the handle may be formed out of ivory and the knife may be elegantly carved, thus making a very handsome ornament.

Before drawing this article to a close, I will say a few words in favour of our English woods, which seem to be much neglected by amateurs in favour of the hard, and consequently easily-worked, foreign woods. Acacia wood, when polished, has a light yellow colour,

with deep gold markings. Many kinds of plum wood, especially the wood of the egg-plum tree, have a beautiful transparent look when polished, and may be obtained with several different kinds of grain. Damson wood has the colour of mahogany, with thick dark bands, and holly wood has a light brownish yellow colour, with very narrow markings. All of these woods, when carefully turned with the gouge and double-bevelled chisel, form excellent paper-knife handles, and would look nicely if fluted; but if high ornamentation is to be used, the foreign hard woods are more suitable.

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## THE WHEELBARROW: HOW TO MAKE IT.

By W. FRIDAY.

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### XI.—THE NAVVY BARROW—A BARROW WITH MOVABLE SIDES—CONCLUSION.

N making a navy barrow, we require a couple of strines, swords, legs, and front brackets, and back brackets, and also a couple of side brackets, one for each side. The wheel is made similar to the box-barrow wheel, with the exception of the bottom of felloes where the hoop fits, where it is  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inches, so that the hoop being this width it is necessary to plane the felloes down to it, Fig. 91, but the top of felloes where curved out, should be  $2\frac{1}{2}$  inches.

The legs of the barrow are fixed at the side instead of at the back. At the back, resting upon the strine, there is a bracket; also another at the front. We have no head-piece or ribs fixed to the barrow.

In setting out the barrow follow the directions given in former papers—in fact, all barrows are set out alike. Be careful in setting out and fixing the swords to the strines, as they are the chief things in barrow-making. Set the strines out, and fix the swords in the strines. Next dress the handles off, so far the strines have been only just roughed over with the plane. Then board the bottom with poplar or elm. When the bottom is in let it project 1 inch at the outside of swords. Now get four brackets, elm or ash,  $1\frac{1}{2}$  inches thick; the



front bracket almost reaches the end of strine and is 9 inches high, and has a bevel of forty-five degrees, the back brackets having the same bevel. These back brackets are not so long or big as the front ones. Get these brackets sawn out, plane under the bracket which fits upon the top of strine, and also the bevel where the boarding has to be fitted to the bevel. Rest them in their places, then put a straightedge across the bevel of brackets; move them until the straightedge is straight across the face of bracket, then nail them with strong nails, 3 or 4 inches long. Bore holes in brackets before driving in the nails. When you have nailed the front brackets, try the straightedge across the back brackets, and when they are right nail them in their place. Next fit the legs upon the side of strine, the bevel of the legs and the side brackets being the same as the other brackets, Fig. 92. Fit the leg near the back bracket, and the side bracket near the front one. Just plane the leg and side bracket, and dress the sharp edges off with the spokeshave or draw-knife; fit these to the strine with bolts.

When both sides are finished commence boarding. The boards are either elm or poplar, but deal is sometimes used; the boarding is 1 foot wide and  $1\frac{1}{4}$  inches thick; the stronger the better. First saw out the front boarding, bevel the bottom to allow it to fit, then nail the boarding to the front brackets. Saw out the back; nail this also, and fit in the two sides. Bevel the bottom and two ends, then nail to the leg and side bracket. Level the top off with the plane, and saw down, and level the ends of the front and back boards. If the tops of the brackets and legs project above the boarding saw them level. No stay is required for the leg, but sometimes a bracket is affixed to the leg and strine. Next turn the barrow over, and fit the noggs to the strine, fit the wheel on the strine, the same as when making the box-barrow; sometimes the axle is fitted in the noggs only; bore  $\frac{3}{4}$  inch deep in the noggs, and put them on the axle; then put the noggs on the strine. Hold your rule upon the strine against the felloes of wheel and revolve the wheel, measure the same distance from each

strine, and when the wheel is fixed in straight, nail the noggs down to the strine. It is advisable to fit two hoops upon the legs. When finished, the barrow, Fig. 93, need not be painted unless preferred. Hooping iron is sometimes nailed across the barrow, from the back brackets to the front, and from one side to another; this iron is cooper's 1 inch hooping iron, it bears the wear and tear in carrying stone setts, cobbles, stones, etc., and should be nailed down with inch flat-headed nails.

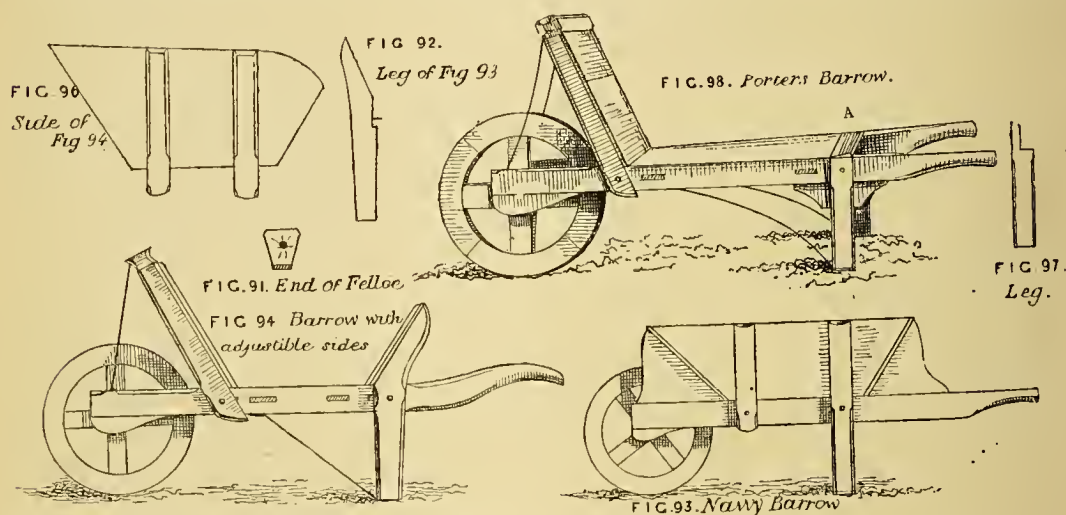
The next barrow is the one with movable sides, and is made in the same way as the box-barrow, indeed, when made you will not perceive any difference between the two. In the drawing, Fig. 94, you will see that the strines are bent near the handles, but this I have drawn by way of a change. These strines are not so numerous on barrows as they were, as the straight ones seem to be liked better. These bent strines can be procured at the timber-yard, and are very little more in price than the straight ones. They are also fitted upon box-barrows.

Get the frame-work of the barrow put together, each piece dressed out, and fitted in their respective places, all but the four side brackets; fit the bottom boarding and the front and back just the same as in making the box-barrow. The bottom, front, and back boarding will be deal, but the sides will be of birch, and each side will be all in a piece. Fit your brackets to the strine, then dress off. Next get four square staples, two for each side of the barrow; the square of the staple, Fig. 95, must be made to fit the bracket, and it should be a little larger, if anything, to allow the bracket fitting. Fit these staples 7 inches apart in a straight line running along the centre of strine. Bore through the strine with a shell bit, then knock in the staples, and turn the points, after they come through, into the wood again, then hold the hammer against one and clinch it; only hit the staples at the ends, but not in the middle, or you will bend that part, and the bracket will not fit in the staple. When all four are in put two of your brackets in the staples.

Fit the side in its place, resting and fitting

against the brackets. This side will be all in one piece, of birch, and must be fully 1 inch thick; you will have to bevel the bottom and two sides of this piece, to allow it to fit. Next nail or screw the side to the brackets just as they are fitted in the staples. Now get four ribs planed; these can be of deal or birch,  $1\frac{1}{4}$  inches thick; plane up straight, and fit in the corners inside and out; when these are fitted nail them to the front and back only, but not to the sides, so that they scarcely touch the side. Dress the top and bottom off, and saw the brackets level, then curve the top of side down to the back. We can now take the side out, Fig. 96, and slide

standards be nearly straight, fasten the front stay to the head-piece, then fasten the leg. The top of leg is  $2\frac{1}{2}$  inches square, and the bottom 2 inches square. Put leg to the side, and level with the top of strine, then mark underneath strine. Set gauge, and mark from the pencil side  $1\frac{1}{2}$  inches; gauge the leg, and saw down the line and across the leg, Fig. 97, then fit the leg to strine; the 1 inch side fits at the outside of strine; bore, and put a bolt through. Next fit leg-stay upon it, put both legs upon the strines, then fit a piece of ash from leg to leg across the top of barrow, 3 inches wide and 1 inch thick; let the inch side be at the back,



it in its place again. Fit the wheel in, and give the barrow two coats of paint.

The next barrow, and the last, is the porter's barrow, and, unlike the others, it has not any sides or back, and the legs are fitted level with the top of the strine. Set the barrow out just the same as before, with this exception, that the bottom is 1 foot longer, therefore we shall require the strines 1 foot longer also. Barrows made like these are used by contractors, slaters, and others, but all the woodwork is of oak, except the boarding; they have also flat bars of iron across the top of barrow, thus saving the woodwork from being splintered, but if the barrow is used merely for carrying hampers or baskets it can be made of ash. Let the front

and plane down to a feather edge to the bottom, Fig. 98, A. Some barrows have a little tripper made at the head-piece; it is 9 inches across, and the same length as the head-piece; two standards are fixed in the head-piece, and then another head-piece fits upon the standards; two ribs or bars are bolted to the standards, or the space can be boarded between the two head-pieces; the stay is almost straight, and goes through the head-piece which is over it. Dress the head-piece, if you like. If this sort of barrow is intended for heavy work paint it Indian red or red lead, but if for light work paint it green.

I would say, in conclusion, that no amateur or apprentice who thoroughly reads and learns

what I have written, can go astray in his work. I do not think I have missed out any little detail which may become a stumbling-block to beginners, but by reading and persevering you will be able to overcome any difficulties, as these papers are especially written, and the drawings sketched, for the amateur's and apprentice's guide to wheelbarrow-making.

## DESIGNS FOR WOOD-CARVING.

By *ROUGE DRAGON.*

(For Illustrations, see Folding Sheet presented with this Part.)

WORK OF THE OLD CARVERS—BEST COPIES FOR BEGINNERS—**PANEL FROM OLD OAK CABINET—TUDOR ROSE DESIGNS—TOP FOR STOOL—BORDER FROM OAK CABINET—A MINIATURE OAK CHEST—PANEL FROM AN OLD PULPIT ADAPTED TO BOX OR COFFER—A SUGGESTION FOR AN OAK FRAME—HINTS TO CARVERS.**



THE style of carving that is required for the designs given here is very simple and not difficult to learn, and the tools used for it are comparatively few. I venture to think those who take up the art of wood-carving would be much more likely to persevere in it, instead of abandoning the work, as too many do, after a few months, with the complaint that it is too tedious, so much time is spent over a very small piece of work, there are so many disappointments over chipping the finest parts, etc., if only they would take very bold and broad work at first, and not attempt the finely-cut and veined leaves, the minute and highly-relieved copies of natural flowers, the little frames and paper-knives, which are so often attempted even by very beginners. Now, we cannot have better, or more easily-copied models, than the work of the old carvers who decorated our oak chests, coffers, settles, bureaux, etc. Some of the work on these, when we come to examine it, is of the roughest description; and yet, how perfectly decorative it is!

The design, Fig. 1, is taken from a panel on the door of an old oak cabinet in my own possession. This cabinet is of the simplest construction; the back, sides, and top are of plain oak, the two doors in front are carved all over;

there are two panels on each, the upper and lower half, and these panels have each a border round them of some different pattern. The panels, and the strips of oak with the borders, are each carved separately and joined together on a plain piece of wood, for the doors.

The panel I give is that on the lower half of each of the doors. The pattern is a most effective one; it stands up about a  $\frac{1}{4}$  inch from the background, and is hardly even rounded off at the edges. To work this, the pattern should be traced off first on to a piece of oak; then, with a broad chisel and hammer, go round all the edges of the design, after which some of the background may be scooped away. The edges will require going round two or three times before the background is deep enough. (The wood should, of course, be screwed down to a steady table with a clamp.) When the ground is quite smooth and even, it may be worked over with a dotted punch. The vein that runs up the stems should be cut out with a V-tool. There are no veins in the leaves, which are left perfectly flat and unworked; but there is a straight line up the centre of the design, which, also, is done with the V-tool.

This is one of the simplest and most easily-worked panels that a beginner can attempt, but, when finished, it more than rewards the trouble that has been spent upon it. Cutting away the ground, in oak, is always rather a tedious process, but there is not a very great amount of it here.

The next designs, Figs. 2 and 3, are taken from some of the many specimens we find of the adaptation of the Tudor rose to decoration in old houses and churches. The shield with the rose, Fig. 2, is taken from the panel on a door leading into a chantry chapel in one of our cathedrals. It requires rather finer and more finished work than the preceding example, but is not really more difficult to work. The ground should be cut away first in the same way; then the outline of the petals, where they turn over, should be cut with the chisel, and the wood under this curve cut away with a small gouge, to bring the turned-over edge into relief. This edge should then be rounded, and also the outer edge of each petal, the stems, and the edges of the



leaves. The veins in the leaves should be cut with the V-tool. The centre of the flower should be rounded as evenly as possible. The little border of Tudor roses, Fig. 3, is copied from some oak carving in an old church in Lincolnshire, and has a beautiful effect. It should be enlarged from the design given, or would be too minute to work successfully. The roses here are double, and each of the rows of petals turn over in the middle; the outer petals have to be cut down rather deeply behind the inner ones, so as to throw them into proper relief. The tools should always be kept *very* sharp, so that they cut the wood away cleanly, without leaving rough or jagged edges or ragged corners. Everywhere the pattern should stand out clearly and distinctly when finished, and the pressure on the tool should be so regulated, that if a slip should occur, as does sometimes unfortunately happen, it should not cause any serious damage, or cut away any very delicate part of the work, which would be difficult or impossible to restore. Make quite sure, before beginning to work, that the wood is firmly and immovably fixed to the table or bench with the clamp. Then, with one hand, press the chisel or gouge in the direction in which it is to cut, holding the other hand on the front of the tool, to restrain the pressure of the hand which impels it forward, and stop the tool from going too far. If this method is attended to, there will be no fear of cutting either the hand or into the pattern.

Our fourth design, Fig. 4, has been worked for the top of a small round stool, with excellent effect. Great care should be taken in cutting the curves of the inner and outer circles, and smoothing them off neatly when cut, as any angles or unevenness are noticed directly in a pattern of this kind. The backgrounds of the different divisions should be worked with punches of varying patterns. I may mention, also, that this design can be worked in metal, copper, or brass, with equal success. The original was taken from an old China plate.

Fig. 5 is a border in oak, taken from the same old cabinet to which my first illustration belongs. It is also very roughly and effectively cut, and should be worked in the same manner

that was described for the panel. The small curved marks in the pattern are cut out with the V-tool, as is also the outline of the circles. The edges of the pattern are just slightly rounded off, but there is very little modelling about it.

I shall hope in a future article to give some other designs taken from old oak furniture, bureaux, cabinets, etc., in my own possession; especially the front of a very beautiful chest, which has a great variety of work upon it.

Not long ago I saw a piece of modern carved work, which struck me as being rather novel and not difficult or cumbrous to carry out. It was a miniature oak chest, the size about 16 inches in length, and 8 inches in height. It was carved on the ends and front, with just such designs as we see upon old chests, reduced in proportion; the patterns were clearly cut, and nicely finished off, in low relief, with punched backgrounds, and, no doubt, the little model had been copied from some ancient example. The front had three panels, divided by borders running downwards and across the top and bottom.

A little box like this (for such it really was) would be an interesting and pleasant piece of work to accomplish, and would be a useful possession afterwards; and, if this was successfully carried out, the worker might be encouraged to make a really durable and serviceable piece of furniture, such as we are so glad to possess in these days, in the work of our ancestors two hundred years ago.

The example shown in Fig. 6 is taken from one of the panels of a very old pulpit, in a disused chapel in one of the Midland Counties. The pulpit is hexagonal, and the pattern is repeated on each of its sides. It is an admirable example of old carving, and a design that may be made use of in many ways. Carved in oak, it would make a very effective panel for the door of a small cupboard; it should be worked in the style of the old carved furniture panels, *i.e.*, the outline of the pattern should first be clearly and decidedly marked out with a chisel if the lines are straight, or a gouge if they are curved; then the ground should be lowered to a uniform depth; a large gouge, used with the mallet, will best

do this, and it can be smoothed and finished off with a chisel. The edges of the pattern, which will now stand up in relief, should be rounded off, and some marks or veins may be added in the foliated parts with the V or parting tool. The background may either be left plain and smooth, or decorated with punching. A small box or coffer might be made, with the top and sides carved with this pattern, in the exact size given, and the ends with only half the design. Carved in ebony, for a box, it would also look very handsome; or in walnut, or some hard white wood.

A frame for a water-colour drawing is a very nice piece of work to do in wood-carving. The drawing should first be put into a white or gilt mount, and then strips of oak, of the right size for the outer frame, should be prepared, about  $2\frac{1}{2}$  inches wide, and just deep enough to allow for the amount of relief in which the pattern is to be carved, as the carved strips should afterwards be fastened upon plain wood for the back of the frame. It is not necessary to make mitred corners; each strip can be cut and joined straight on to the next, and the joins will not show when the carving is done, if a little trouble is taken about fitting the pieces, and bringing the two sides together in the carving. A Runic pattern, of interlaced bands, looks very well on a picture-frame, or a conventionalized garland of flowers, such as marigolds, iris, or single roses. Laurel leaves are effective as a garland, or willow, the long, narrow, curved leaves of which are very graceful and decorative.

A design made from some flower or plant, which has a reference, or is appropriate in some way, to the picture of which it forms the frame, would add very much to the interest and delight of the whole; and a frame which costs some ingenuity to plan and design, and which is an expression of the fancy and invention of the worker, is worth infinitely more than one that has been bought ready to hand, however elaborate and handsome it may be. Designs of flowers used in this way should be carved in low relief, with no attempt at realism, or at imitating all the details of nature, but should be kept as conventional as possible. Beautiful

frames for mirrors can also be made in carved oak.

The great difference between the tools used for carving and those intended for ordinary carpentering is, that the carving tools must be sharpened on *both* sides, while the chisels, gouges, etc., used for other work are only sharpened on *one* side. To put a proper edge on tools for the work of which I have been speaking requires a good deal of practice and experience, and several hones of different thicknesses are needed; they should be moistened a little with water, which is better than using oil, and the tool rubbed up and down briskly upon them. Great delicacy is required in giving the final edge to the tool.

A small, very stoutly made, and steady table is much the pleasantest to work upon, the annoyance of having a rickety and shaky table very much interferes with the pleasure of carving in wood. It is better, also, if possible, to screw the wood itself down to the table, instead of using a clamp, which is apt to slip sometimes, and also gets very much in the way of the worker. A margin may be left outside the part to be carved, which can be cut away afterwards, or, if the pattern is one which is pierced through in some parts, that will give spaces where the screws can be put in. This method will keep the work much more steady than any clamp will do. When a piece of carving is finished, it may be rubbed over with a piece of flannel dipped in linseed oil, if a darker colour is preferred for the oak.

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USEFUL CEMENTS.—“For mending valuable glassware, use a cement made with five parts gelatine to one part of a solution of acid chromate of lime. Cover the broken edges with the cement, press the parts together and expose to sunlight. The light hardens the cement, which will then withstand boiling water. For sticking leather, paper or wood to metal, use glue to which has been added a little glycerine—say, a teaspoonful of glycerine to a gill of glue. This is a good cement for fastening labels to cans.”—*Builder and Wood-worker*.



## THE AMATEUR DEMONSTRATOR.

LIGHT (*continued*).

By OLIVER BECKERLEGGE.

## II.—EXPERIMENTS WITH REFLECTED LIGHT—THE KALEIDOSCOPE—REFRACTION—AN ILLUMINATED CASCADE.



N performing experiments by reflected light a very important fact must be remembered, that is, that various substances reflect light in different degrees, and that the same substance reflects light at different angles.

Thus, if a ray of light falls perpendicularly on water, only 18 parts of a 1,000 are thrown back, the remaining portion entering into the water. Light falling under the same conditions on glass, 25 parts are reflected; whilst mercury reflects 666 per 1,000. If, however, light strikes a surface at an angle, then a greater portion glances off or is reflected. A simple experiment will show this. Over a vessel of water place a point of light. Now, if seen at an incidence of  $40^\circ$ , *i.e.*, just  $5^\circ$  from the perpendicular, 22 rays are reflected; lower the eye to  $60^\circ$ , 65 rays; at  $80^\circ$ , 333 rays; and at  $89\frac{1}{2}^\circ$  (or almost grazing the surface), 721 rays per 1,000 are reflected; which is as much as mercury reflects at the same angle of incidence.

On looking at a glass mirror obliquely, we see the image of an object reflected many times over, but each reflection fainter, until it dies out. The first image is reflected from the front of the glass, the second, and much brighter one, is from the silver at the back of the glass. Now, it will be seen, that if we look at an object perpendicular to the glass, the two reflections travel in the same path and enter the eye at the same point, hence there is but one image seen; but when the object is seen at an angle, the reflections travel on diverging lines, and so enter the eye at different points.

Let us see how these reflections take place. A portion of light strikes the glass and is reflected, but a larger portion passes through, and is reflected by the silver. In its outward passage, the larger portion passes through the glass and reaches the eye, but a portion glances from the inner surface of the glass, and is thrown back

to the silver, which throws it again forward; but a portion only of this reaches the eye, for a portion is again thrown back by the inner surface of the glass. Thus a decreasing quantity of light vibrates to and fro between the two surfaces of the mirror, until the reflections are too feeble to be perceived.

Another interesting experiment may be made by placing two mirrors at an angle, when an image will be repeated a number of times, determined by the angle. It is on this principle that the effects of the kaleidoscope depend. This instrument is not only one of much interest, but has been used with advantage for the purpose of producing new patterns and designs. Procure or make a tube, 6 inches long by  $1\frac{1}{2}$  inches in diameter; cut three strips of glass,  $\frac{1}{2}$  inch shorter than the tube, and of such a width that when placed at an angle they will slip tightly into the tube; they may be fastened together by gummed paper.

If the mirrors are brought level with one end of the tube, we shall have  $\frac{1}{2}$  an inch space at the other end. Cut a small circle of glass, and drop it into the tube to rest on the mirrors. Now take a number of bits of coloured glass, no attention need be paid to their shape as long as they are not too large. Close the end of the tube with a disc of ground glass, or, failing that, gum thin tissue paper on the inner side of a disc of common glass. The other end must, also, be closed with a disc of glass; this should be covered with an opaque paper, excepting a central eye-hole. On turning the tube the bits of glass will fall into position, and their images will be multiplied so as to present a complete pattern.

Another phenomenon closely related to Reflection is Refraction. A ray of light passing from a rare medium through a denser one, is bent out of a straight line and forms an angle. As a rule, when passing into a denser medium light is bent toward the perpendicular; but to this there is one exception. Place a vessel so that the light of a candle shall throw a shadow of its side on the bottom. Now pour water into the vessel, and we shall see that the shadow no longer falls in a straight line with the candle,



but is bent toward the perpendicular, Fig. 8. Again, in an empty vessel place a coin; bring the eye in a line with the edge of the vessel, until the coin is hid. Now let someone carefully pour water into the vessel, and the coin will appear in sight, Fig. 9; A, B, D, shows the

Should it meet with an obstacle standing at right angles to its path, it will rebound and travel backward on its own path. Should the obstacle be oblique to its path, one wheel will strike first, the other will swing around, and the rebound will not be on its original path nor

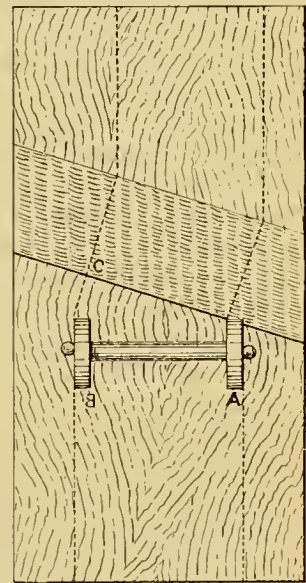
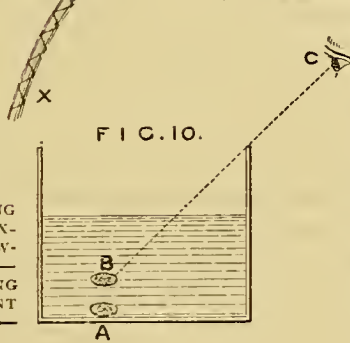
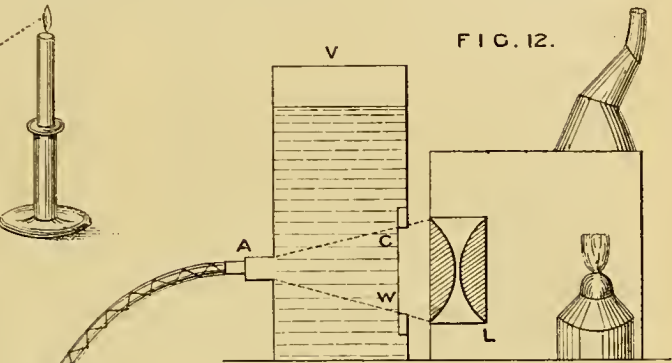
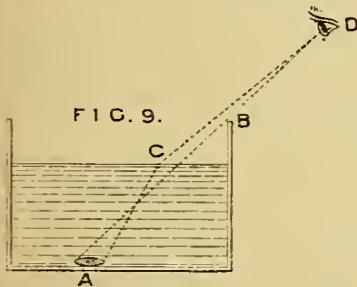
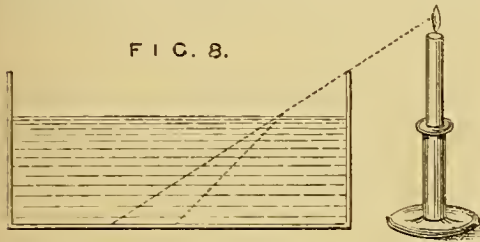


FIG. 8.—DEFLECTION OF LIGHT PASSING THROUGH A DENSE MEDIUM. FIG. 9.—EXPERIMENT WITH COIN UNDER WATER SHOWING DEFLECTION OF LIGHT. FIG. 10.—APPARENT POSITION OF COIN UPON FILLING VESSEL WITH WATER. FIG. 11.—EXPERIMENT ILLUSTRATING "DEFLECTION." FIG. 12.—AN APPARENT STREAM OF MOLTEN METAL.

ray of light in air. When water is poured in the vessel the rays of light are brought toward the perpendicular, as A, C, D. The optical effect is as if the coin were raised nearer to the surface, as Fig. 10. It is obvious that if the coin were raised from the bottom from A to B, it would be visible at C. It is on this principle that a vessel of water or a pond looks so much less deep than it really is.

If a beam of light is bent toward the perpendicular on entering a denser medium, it is natural to determine that, when entering from a dense to a rare medium, it will be bent from the perpendicular. A simple but interesting experiment will make this plain. On a spindle fix two freely revolving discs as wheels, Fig. 11. Now, if it be propelled forward on a perfectly level surface, it will pursue a straight course.

perpendicular to the obstacle, for the wheel that strikes first will naturally rebound first, and, putting friction out of the question, the spindle, theoretically, would start from the obstacle at an opposite angle to its original path. Here, then, we have an elegant little experiment illustrating Reflection. We see that the spindle reflected from a surface perpendicular to itself travels back over its original course, whilst from an oblique surface its angle of reflection is the same as the angle of incidence.

But our spindle illustrates more than this—it will explain Refraction equally clearly. On a

FIG. 11.

level table place a strip of cloth or baize at right angle to the line travelled by the spindle, and we shall see that the only effect will be to retard the speed; this corresponds to a beam of light entering (say, water) perpendicularly. Now let us place the cloth on the table at an angle with the path of the spindle, and we find that refraction takes place both on entering and leaving the cloth. The wheel, *a*, striking the cloth, first receives an instantaneous check, which allows wheel, *b*, to swing around, which will cause the spindle to travel in the direction of *c*; but as *a* was the first to enter on the cloth, so it will be the first to leave, and being freed from friction will swing around in the opposite direction until *b* also leaves the cloth, when the spindle will pursue a path parallel with its first.

Now, fancy a beam of light entering a dense medium like water, which offers resistance to it, that side of the beam that strikes first is retarded, whilst the other side swings around and pursues the course shown by our experiment.

These two properties, Reflection and Refraction, make manifest all visible phenomena, and without them vision would be impossible. Everyone has observed that the image or reflection of an object in a mirror in a room is somewhat less brilliant than the real object. The wall-paper and ceiling, for example, are somewhat lower in tone.

This arises from the fact that the most perfect mirror fails to reflect all the light. Some is quenched, that is, the vibrations are arrested; other are refracted, and so do not reach the eye. We can, however, by taking advantage of the two laws we have been illustrating, secure *total reflection*. We have seen that a beam of light striking water at an angle of  $89\frac{1}{2}^{\circ}$ , or just grazing the surface, has 721 parts in 1,000 reflected. We have also seen that light entering a denser medium is bent toward the perpendicular, and, in passing into a rarer medium, is bent from the perpendicular. Now, keeping these two facts in mind, we see that if a beam strikes the surface of water a little over  $90^{\circ}$ , or just grazing the under surface of the water, 721 rays out of the 1,000 are reflected; but there are still 279 rays to be

accounted for. Now these rays entering the air are bent *from* the perpendicular, and enter the water again, or, rather, never leave the water, and so the whole beam of light is reflected.

There are various experiments to illustrate this—a simple one is to place a coin, say, a shilling, in a glass containing a little water. Tilt the glass to one side until the eye can look at the under surface of the water, then the reflection of the coin will be seen as bright as the coin itself. Or, take a test-tube, and place it in a similar position, it appears as burnished silver. Now pour water into the tube, and we shall see that it no longer reflects, but transmits, the light, as the light medium air gives place to the denser medium water. The following is a very brilliant experiment. Take a tin vessel, 10 inches high, 12 inches wide, and 4 inches from front to back, a section of which is given in Fig. 12; in one side, near the bottom, an opening, 4 inches in diameter, must be made and closed with glass. In the other side, and exactly opposite the centre of the window, a small opening must be made 1 inch diameter. On the inside of the large opening two lugs should be soldered; the glass can be bedded with putty, and the lugs be bent over the glass, so as to prevent the glass from being readily displaced. The small opening must be plugged with a bored cork, into which a short length of brass tubing is to be inserted. Care must be taken that no roughness is on the inner edge of the tube, else it will prevent the flow of a perfect column of water. Remove the front lens of a magic lantern, and bring the condenser so close to the window that the apex of the cone of light falls upon the small opening; this can be easily arranged after a few trials. When the vessel is empty, the light from the lantern will pass through the opening, *A*, and show itself as a bright spot on a sheet or wall. Now let us fill the vessel with water; a bright spot no longer appears, but the stream issuing is powerfully illuminated, and appears like a stream of molten metal, and breaks up into a thousand splendours in the vessel placed to receive it. The reason is simply this, the beam of light strikes the inner surface of the issuing stream, and is both reflected and refracted, as we

have already seen; the beam so reflected strikes the opposite internal surface, and is again dealt with in the same manner, and is thus prevented from escaping, but is held within the column until liberated by the breaking up of the stream, Fig. 12—v, vessel; L, lantern; c, cone of light impinging on the small opening; w, window; x, beam of light reflected and refracted.

## PORTABLE HARMONIUM BUILDING.

By ERNEST A. SANDERSON.

### VI.—BOX FOR THE HARMONIUM.

AVING completed the construction of the harmonium proper, we will commence operations upon the box or case, in which the instrument will stand when in use, and in which it will be conveyed from place to place when the owner desires its removal. I may safely assume that no one will undertake this work unless somewhat skilful in carpentering; therefore, it will be needless and out of place for me to detail here how to make the box—or rather, I should say, to explain such rudimentary work as, for instance, the mode of mortising or rabbeting parts together. This would be an unnecessary adjunct to the information supplied in this chapter, besides occupying too much valuable space; hence, it will be sufficient to simply state what has to be done. Let us take the separate pieces in the most convenient order for fitting them together when made.

*The Base.*—Following the usual procedure, we will make the bottom first, for which two  $\frac{1}{2}$  inch deal or pine boards, 2 feet  $7\frac{1}{2}$  inches long by  $6\frac{3}{4}$  inches wide, are required. Plane both sides of the boards, and afterwards glue them together.

*The Back.*—This part, as also the sides, front, and top, should be made of walnut (of course, the foregoing part of this sentence does not apply to amateurs who prefer to grain deal to represent the wood they require), and as the parts are to be panelled, two thicknesses of stuff must be employed—that for the stiles and rails 1 inch, and for the panels  $\frac{1}{2}$  inch. The stiles

and rails forming the back piece, which should all be 3 inches wide, must be neatly mortised together; those at the ends should be  $16\frac{1}{2}$  inches long, the middle one  $10\frac{1}{2}$  inches, and the top and bottom rails  $24\frac{1}{2}$  inches, as indicated in Fig. 31. The edges of the panels should be chamfered off to fit into grooves,  $\frac{1}{4}$  inch wide, made in the edges of the stiles and rails for this purpose.

*The Lid.*—Like the previously described part, the lid may be dealt with in very few words, inasmuch as it resembles in appearance and construction the piece just referred to. Its size is a repetition of the dimensions of the bottom board (2 feet  $7\frac{1}{2}$  inches by  $13\frac{1}{2}$  inches), and its panels should correspond with those in the back piece; but the stiles and rails should be made  $3\frac{1}{2}$  inches in width— $\frac{1}{2}$  inch wider than those in the previous part. Finally, fix round the edges a 1 inch by  $\frac{1}{2}$  inch bead.

*The Sides.*—I give, in Fig. 32, a sketch of one of the sides, which sufficiently explains itself for our purpose—the stiles being  $16\frac{1}{2}$  inches by 3 inches, and the top and bottom rails  $6\frac{1}{2}$  inches by 3 inches. Two brass handles, strong enough to bear the weight of the instrument, are to be fixed in the centre of the panels.

*The Front.*—This part, which has two distinct portions—to wit, the *frame*, and the *sliding-front*—presents a decided contrast to the preceding pieces in point of complication of construction, but I have little doubt that the worker will be able to thread his way through the explanation, with the aid of the diagram (Fig. 33).

To make the frame in which the movable front will slide, plane up two pieces of walnut, each  $16\frac{1}{2}$  inches long, by  $3\frac{1}{2}$  inches wide by 1 inch thick; and another  $23\frac{1}{2}$  inches in length by 1 inch square, afterwards mortising the parts nicely together. Then, fix all round this frame a  $\frac{1}{2}$  inch half-round bead flush with the front edge. The top and bottom rails of the sliding-front are each in length  $16\frac{1}{2}$  inches, side stiles 15 inches, and middle stile 9 inches, while all are to be 3 inches wide. When these stiles and rails have been joined together as hitherto (by mortising), brad round the sides and bottom a piece of  $\frac{1}{2}$  inch square wood, the back



edge of which should come flush with the corresponding edge of the sliding-front. This addition will effect two purposes—first, by forming a kind of guiding ledge it will allow the movable front to slide more easily into its frame; and, second, it will increase the width of the former piece to  $23\frac{1}{2}$  inches, making it the same as the distance between the legs of the instrument, in which position, it will be remembered, it has to be fixed when the instrument is in use. It will also be advisable to glue thin

oval, round the top of the box, with the square edges flush with the inner edges. The  $\frac{1}{2}$  inch angle caused by rabbeting at each corner of the box, may be filled with a quite round  $\frac{3}{8}$  inch bead.

Before the lid is permanently attached, the harmonium should be fixed in its proper position in the box; but there are two things which require the worker's consideration before he starts even this.

In the first place, it would not be particu-

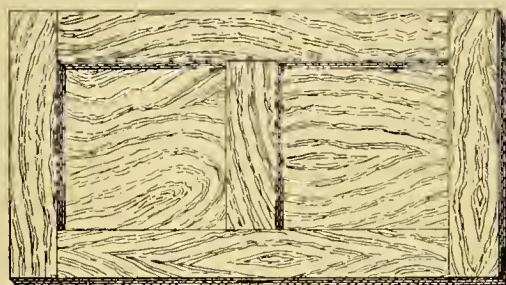


FIG. 31.—BACK OF BOX.

SCALE OF  
FIGS. 31, 32, AND 33.  
1 IN. = 1 FT.

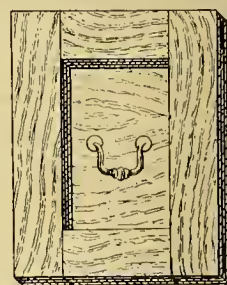


FIG. 32.—END OF BOX.

strips of wash-leather on the two side pieces of this ledge, to prevent the legs being scratched, and also to cause the sliding-front to wedge itself more firmly in its slanting position (see Fig. 1, page 376, Vol. I.).

The next step will be to attach the separate parts together, which may be commenced by cutting on the inside edge of the ends of the back and front pieces a  $\frac{1}{2}$  inch by  $\frac{1}{2}$  inch rabbet, in order that the sides may fit in their places neatly, and be fastened by brass cups and screws. When these pieces are fixed together, screw the base on strongly, as it will have to bear the weight of the harmonium.

To give a finish to the lower portion of the box, brad along the edges of the bottom board (which come flush with the outside of the box), a  $\frac{1}{2}$  inch semi-round bead. Then also fasten some strips of wood, 1 inch wide and  $\frac{3}{8}$  inch thick, having the rear edge square and the other

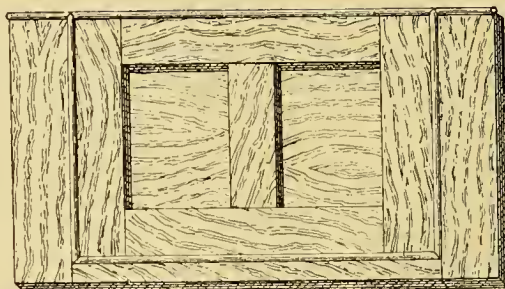


FIG. 33.—FRONT OF BOX.

larly safe for the bottom board of the box to receive the entire weight of the harmonium when it is being carried about—nor, indeed, would the treadles be improved by being jammed against the treadle-board by the pressure of the upper part

of the instrument; therefore, some plan must be adopted to relieve the treadles and the bottom of the box from all such unnecessary weight, and I feel convinced that this difficulty is successfully overcome by the simple contrivance which is given below. Secondly, it will be remembered that I alluded in Chapter I. (*vide* page 378, Volume I.) to a part of the work connected with the treadles—namely, that of carpeting them—which I considered advisable to leave till the last thing, in case the carpet should be spoilt during the further construction of the harmonium. But as it would be found somewhat inconvenient to cover the treadles when the instrument is firmly fixed inside the box, it

would, perhaps, be as well to do this previously. The carpet should be, if possible, of the same pattern and shade as that which covers the floor of the room in which the instrument will stand, and may be attached either by glue or brads. Then, on each treadle, about 1 inch from the front edge, fix with screws at each end a half-round brass rod for the heels to rest on.

The method by which the former difficulty

board as possible, by means of a small piece of chain and hook—the latter being fixed to the edge of the treadle, and the chain to the board. Finally, in order to relieve the hinges of the lid from undue strain when the harmonium is standing open, fasten a hook on to the lid in the position indicated in Fig. 34, and a staple in a corresponding position on the side of the instrument.

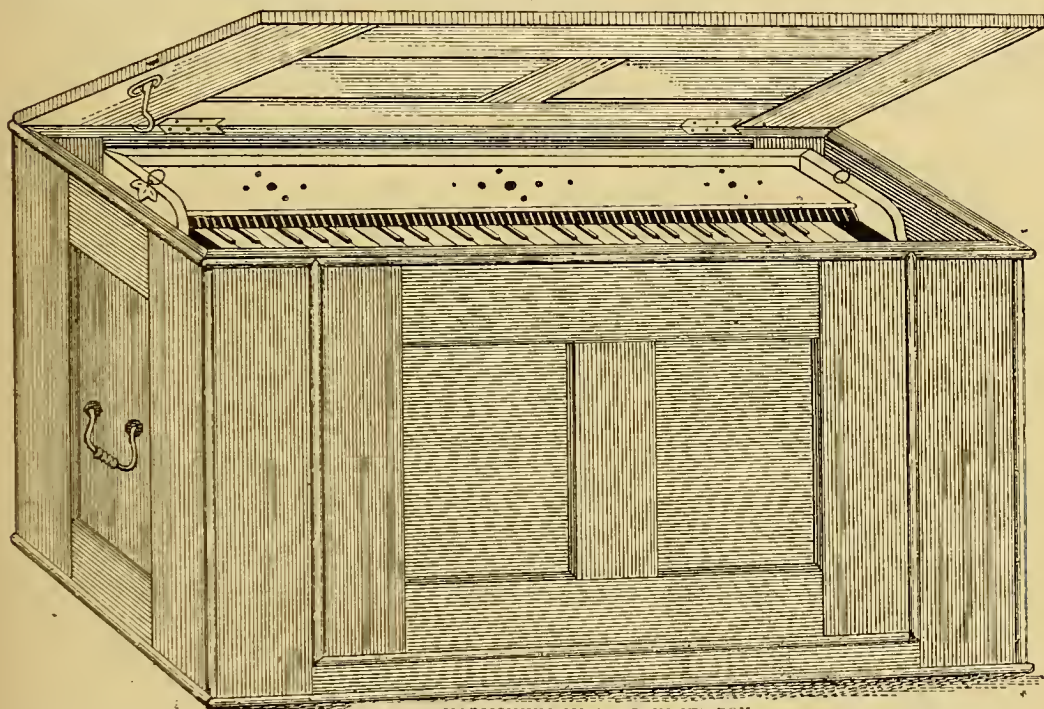


FIG. 34.—HARMONIUM SHUT UP IN ITS BOX.

may be “knocked on the head” (as vulgar little boys express it), is as follows: Detach the upper part of the instrument from the legs, place the lower part in the box, and afterwards firmly screw the treadle-board to the bottom. Then, screw two pieces of wood,  $12\frac{1}{2}$  inches long by  $1\frac{1}{2}$  inches square—and having wash-leather glued on the top edges—on the inside of the box,  $8\frac{1}{4}$  inches from the bottom, to support the upper portion of the harmonium (*i.e.*, the wind-chest, reservoir, key-board, etc.) when it has been re-connected to the legs. Lastly, with two strong brass hinges, attach the lid to the box.

Before folding the instrument up, the treadles must be fastened as close to the foundation

In the succeeding chapter I shall hope to help the amateur harmonium-builder with a few hints on the method of graining and polishing the woodwork.

(To be continued.)

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PRESERVING MOUNTING SOLUTIONS.—An excellent means of preventing the formation of mould in such mounting solutions as those of gum, gelatine, strong glue, starch, arrowroot, and white of egg, is the addition of a little quinine. Ten centigrammes of sulphate of quinine are amply sufficient for 100 grammes of solution (about  $1\frac{1}{2}$  grains to  $3\frac{1}{2}$  oz.).—*L'Amateur Photographe*.



## ADJUSTABLE BAROMETERS: HOW TO MAKE THEM.

By JNO. H. MILNE.

I.—PURIFYING MERCURY—EFFECT OF MOISTURE—DRYING MERCURY—THE TORRICELLIAN VACUUM—WHY THE MERCURY COLUMN RISES AND FALLS—THE TRUE HEIGHT OF THE BAROMETER—ADJUSTING SCALE OF ORDINARY BAROMETER—THE SIPHON BAROMETER—DETAILS OF CONSTRUCTION.



It is proposed in these papers to deal with the construction of instruments of a more complicated nature, but which are more accurate than the class previously described.

In purifying mercury for barometrical use, we must get rid of—First—the grosser impurities as dust, dirt, solid particles, and alloys, and—Secondly—moisture and air.

If the mercury is enclosed in a clean bag of chamois leather, the neck twisted round to securely close it, and then the bag pressed by the hand from the neck downwards, the metal will ooze through the pores of the leather, like silver rain, and will thus be filtered from solids.

The mercury can also be treated by the process formerly described, which will act as a test of the above process, namely, fold a sheet of clean note paper in the form of a funnel, then prick a few holes with a needle in the bottom. The mercury, when poured into the paper, will run out through the holes into the receiver, leaving any dirt and alloy in rings on the paper.

The next process the mercury should undergo is the nitric acid process, also formerly described, and which shortly is this: Diluted nitric acid is poured on the top of the mercury, which should be contained in a shallow dish, the impurities are absorbed in the solution, which becomes discoloured. The washings are changed from time to time, and the mercury frequently stirred.

This process may take days or weeks before the impurities are fully withdrawn, after which the mercury must be thoroughly freed from all traces of acid and also from damp, which leads us in the next place to consider the subjects of—Air and moisture.

It will clearly be seen that damp very prejudicially affects the barometer when it is

remembered that the correct working of the instrument depends on the space between the top of the column of mercury and the top of the tube being devoid of air. The more perfect the vacuum the more exactly the instrument will work, the explanation being that the weight of the air pressing on the mercury at the exposed surface in the cistern should just balance the mercury column in the tube; the lighter the air the lower the mercury, and *vice versa*. This, however, can only be the case if no pressure is caused on the upper surface of the mercury near the closed end.

Now, if any air or moisture is in the mercury it will, as bubbles, gradually rise, and finally burst on the surface of the metal, each bubble tending to destroy the vacuum. The air thus accumulated acts as a cushion and presses down on the mercury column, overcoming the proper balance between the air and the mercury, the result being that the barometer registers a more depressed and lower reading than is correct.

The purest mercury is obtained by distillation, which is a difficult process and dangerous to the health. However, the metal may be brought to a satisfactory state of purity by the process formerly described, or by the following, which is rather more difficult to perform, but which is usually adopted when the more expensive barometers are made. The mercury should be first boiled in bulk, afterwards a small quantity poured into the barometer tube, and then boiled by means of a spirit lamp. A little more of the heated mercury should then be introduced and boiled, and so on till the tube is full. By this means all air and moisture are expelled.

If only a portion is boiled at intervals, after each instalment is introduced the tube should be perfectly corked to prevent the entry of air. This process, also, gives off poisonous fumes, and requires to be carefully performed in order to prevent the cracking of the tube and the injury to the operator by inhaling the mercury fumes.

Boiling is the only sure method of obtaining perfectly dry mercury, which is required for the construction of the most accurate barometers used in scientific work, *i.e.*, meteorological observations. The method of treating the mercury adopted



in making the siphon barometer, referred to later on, will, no doubt, answer the reader's purpose. Having described the purification of the mercury, and before proceeding to the construction of the siphon barometer, it may be advisable to explain to the reader the principle upon which the barometer acts, so that the instruments subsequently described may be fully understood.

The weight or pressure of the air on all bodies is about fifteen pounds to the square inch, that is, if a column of air measuring a square inch at its base extended to the summit of the atmosphere, its weight would be fifteen pounds. Now, water being many times heavier than air, a column of water of thirty-four feet would balance a column of air.

Galileo discovered that water would not rise in the ordinary pump to more than thirty-four feet. Torricelli, the inventor of the barometer, having directed his attention to the subject of his master Galileo's discovery, concluding that as it was the weight of air which caused water to rise in a pump, he inferred that in proportion as the weight opposed to the air was greater, the quantity required to counterbalance the air would be less. He therefore proceeded to experiment with mercury, which is thirteen and a-half times heavier than water, and which, he thought, should only rise to thirteen and a-half times the height of water.

He inverted a tube of mercury in a receiver of the same metal. The mercury in the tube fell to about twenty-nine or thirty inches and then remained stationary. His experiment completely proved the correctness of his hypothesis, and mercury has since been used in barometer making.

Two cubic inches of mercury, it will be found, weigh one pound, therefore thirty inches of mercury in height would balance the column of air. Of course, the top of the tube had to be closed; otherwise, the pressure of the air acting on the surface of the mercury in the tube being quite as great as on the mercury in the cistern, while to the weight of air acting on the mercury in the tube is added the additional weight of the column of mercury, the result would be, of

course, that the mercury would run out of the tube till it found its level in the cistern.

The top of the tube, however, being closed, a vacuum, as stated, is produced at the upper end when the tube is inverted and the mercury falls, and the weight of air pressing on the surface of the mercury at the open end of the tube, thus balances the column.

The vacuum at the top of the tube is called the "Torricellian Vacuum," after the name of its inventor. It follows from this that when the air is light, as in rainy weather, it cannot support the column to the same degree as previously so the latter falls. On the other hand, the weather being fine and the air heavy, it presses with greater force on the mercury and raises it. Thus there is a constant balance and varying pressure.

Now the reader will be in a position to notice that the true height of the barometer is not the height in inches at which the top level in the tube stands, but is the measurement or difference between the two levels, the cistern and the tube. When the level of the mercury in the tube, *A*, rises, the level of the mercury in the cistern, *B*, sinks, Fig. 1.

As stated in the former article, in all ordinary barometers used for household purposes this fluctuation in the cistern is not taken into account, as, if the area of the cistern, *B*, is large compared with the diameter of the tube, *A*, the rise and fall in *B* will be almost unnoticeable, but as all barometers used for accurate observation do take this into consideration, and as this is the principle on which the barometer acts, it is proper to refer to it.

The first class of barometers to be noticed can be made precisely as described in the last volume, the only difference being in the scale.

As the mercury, say, falls in *B*, it rises in *A*, but only in the proportion of the superficial area of *B* to *A*. If the proportion is *B* ten to *A* one, then if the mercury rises in the tube, *A*, one inch, it will sink in *B* one-tenth of an inch, so that the true reading is a rise of one and one-tenth inches. Now, instead of observing the rise of one inch in *A* and adding the one-tenth fall in *B*, the inch scale is shortened by one-tenth, and only

measures nine-tenths of an inch to represent one inch, the same result will be obtained.

Therefore, in order to adjust accurately the scale of the barometer described on page 476, Vol. I. (First Series), it will have to be found what proportion the fall in B bears to the rise in A. If, say, one tenth to the inch, then the scale which measures four inches will have to be four inches long less four-tenths, that is three

The two tubes or legs should then be quite parallel and as near as possible, one or one and a-half inches between the tubes will do very well. They will appear as at Fig. 2, a. If the tube could be bent as in Fig. 2, b, it would look better when mounted.

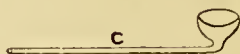
In filling the tube with mercury pass the metal through the chamois leather or paper, or both, and the acid bath, then heat the metal to



FIG. 1.



FIG. 2.



c

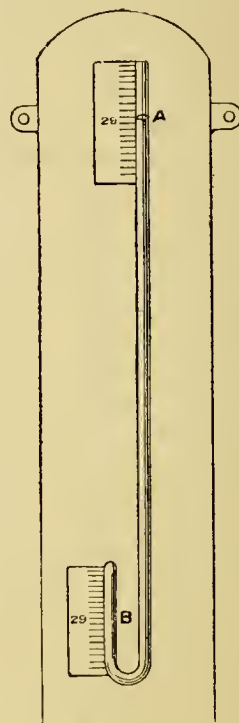


FIG. 3.

FIG. 1.—SHOWING HOW TRUE HEIGHT OF BAROMETER IS DETERMINED.

FIG. 2.—  
(a) TUBE FOR SIPHON BAROMETER.  
(b) ALTERNATIVE SHAPE OF TUBE.  
(c) FILTER.

FIG. 3.—SHOWING SIPHON BAROMETER MOUNTED.

and six-tenths inches, which is to be divided into four parts representing inches, and each inch into ten parts for degrees.

To construct the siphon barometer, procure a tube about  $\frac{1}{4}$  inch bore and 40 inches long, clean it perfectly, close one end by the process described in the former article, taking care to retain the tube perfectly straight. Then, at a distance of about five or six inches from the unclosed end make a clean bend. If the bend is too sharp it will not only interfere with the action of the barometer, but the tube will be almost sure to break at that point

about 100 Centigrade or 212 Fahrenheit. Having thoroughly dried and heated the whole tube, lay it down with the short tube uppermost, then obtain a small filter shaped like Fig. 2, c. This can be inserted in the short tube. A small quantity of mercury can thus be easily passed round the bend at a time till the long tube is full to the bend. The tube, on being carefully brought to the perpendicular, will be found to be very free from bubbles. If any should appear during the filling process, the tube can, when filled, be slightly raised at one end, then at the other, when the bubbles formed will combine

and burst at the top of the metal; or the tube can be raised to the perpendicular, with the closed end downward, and slightly tapped, when, if there should be any bubbles, they will gradually rise to the top and pass out at the bend and open end. It is not advisable to do much of the tapping process, as it often tends to form small bubbles, which may escape observation owing to being so minute, but in time combine and become a serious defect, as well as being unsightly. The final process of heating the mercury in the tube can be added, if desired.

The wooden back or base must now be made. Get a piece of mahogany about 38 inches long, about 4 inches broad, and  $\frac{3}{4}$  inch thick. This is for the tube to rest on. The cross pieces of iron can be affixed to the back. The eyes to hang it by, and brass clamps to screw the tube to the base, can all

be made as described in Article I. The tube will then appear as in Fig. 3.

Sometimes two scales, such as formerly described, are pasted on the base, so that the level, A, will correspond with the level, B, i.e., if the mercury at A stands at 30, then the other mercury level will stand at 30 also. This, of course, can easily be done by setting A, when all is completed, by some neighbouring standard barometer, and making the lower index to correspond.

The barometer will be much more convenient if an index or pointer is affixed, so as to set the level; or a piece of wood, graduated as a foot rule, can be affixed to the frame parallel with the glass tube, which will act in the same way. The scales in this case will be the full 4 inches. This method is, however, older and more awkward than the adapted scale, and, further, if, as in this case, the two tubes are of the same diameter, it is unnecessary and inconvenient to have a scale on the lower tube. The rise or fall in one tube is exactly equal to the fall or rise in the other. Therefore, the scale

can be made just half the length, viz., 2 inches instead of 4 inches. This is divided into four parts representing inches, and each inch into ten parts representing one-tenth.

(To be continued.)

## BRIDGE FOR BAGATELLE BOARD.

By A. SINUS.



IN former Parts of this Magazine instructions have been given for making a bagatelle board complete in itself, but without the bridge which is used in playing a game allied to the ordinary one. As

many may wish to adopt this alternative game in which, without going into rules and regulations for playing, it may be said that the balls instead of being played into

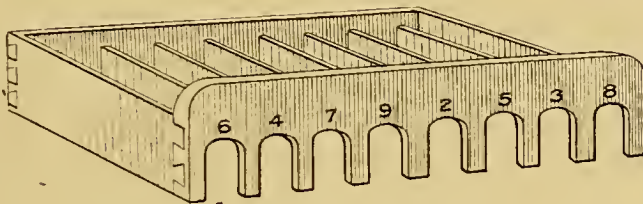


FIG. 1.—BRIDGE FOR BAGATELLE BOARD.

the sunk holes in the board are passed through a piece of wood with openings just large enough to admit of free passage. In the main, this is the bridge; but for convenience when playing the contrivance used is a little more elaborate, as will be seen from the illustration, Fig. 1, which represents the thing complete, with framing and partitions, to keep the balls from mixing up after they have passed under the front or bridge board. With this brief general explanation it seems almost unnecessary to dilate on the construction, for, no doubt, many workers will be able to dispense with detailed directions, while those who are not sufficiently conversant with joinery would probably be able to rig up something which would answer the purpose sufficiently well, although it might not look so nice as they would like. It is, therefore, rather with a view of helping this latter class of workers, than of directing those who are more experienced, that the following hints are given, which it will be noted, refer only to the construction of the bridge, and not to its use. Although measure-



ments are given, it is not to be inferred that these must necessarily be strictly adhered to, as they are given more by way of suggestion than anything else.

There are, however, certain points which must be observed, and it may be as well to call attention to these few essentials now, so that the maker may have a clear idea of what is wanted. First of all, the bridge or front must be in length sufficient to reach right across the board, and high enough to admit of the openings for the balls being cut in them, while leaving sufficient space for figures above. The back, sides, and partitions need only be high enough to keep the balls within bounds. With this we may proceed to the construction

Having got a piece of wood of about 1 inch stuff, and suitable width, which may be considered as  $1\frac{1}{2}$  inches or 2 inches more than the diameter of the balls, it must be set out for eight equidistant openings. The closer these are together, or, in other words, the wider they are, the easier will be the play; for it will at once be perceived that more skill will be required to play through a hole just sufficiently wide to allow a ball to pass than through a larger one. For the sake of appearance, the tops of the openings are rounded or arched, as shown in Fig. 1, and this may easily be managed with a bow-saw (the ordinary fine fret-saw would hardly be strong enough for 1 inch stuff), the marking off having been previously done with the aid of square and compass. As, however, all may not be able to arch the openings, it may be suggested that these may be left square. The crossgrain cuts can then be managed with an ordinary saw, and the pieces chopped out with a chisel. It may be worth while to remind the novice that the chisel cuts should be made from each side of the wood, as the result, by the avoidance of splitting or tearing, is considerably better than it probably would be were the stuff to be chopped out from one side only.

For the sides and back rail  $\frac{3}{8}$  inch or  $\frac{1}{2}$  inch stuff, of, say, 2 inches width, will do very well. The length of the back piece will naturally be exactly the same as that of the front or main portion. The sides may be 9 inches long, but

an inch or so, more or less, is of small consequence. The joints at the back corners may be of the ordinary plain dovetail, but in front the lap dovetail, or that which is commonly used in attaching the fronts and sides of drawers, will be preferable. In fact, if we regard the pieces of the frame so far as being the corresponding parts of a drawer, a correct idea of the joints will be got, always remembering that the bottom edges of all the wood of the bridge must lie flush on the bagatelle board.

The partitions may be a little narrower and thinner than the back and side pieces. Seven of them will be required, the length of each being a little longer than the distance inside between back and front into which they are grooved. The depth of the groove in the front piece is of small consequence, but if it be made about  $\frac{1}{8}$  inch it will be quite sufficient. These grooves should be carefully marked, and cut out either square or V-shaped, and it need hardly be said that, for the sake of neatness, they should be stopped at just the height of the partitions which, after gluing the frame together, will be run into them from below. The partitions may hold in without any glue, but it will be better, especially if any of them show a tendency to looseness, to use a little, as it cannot in any case be a disadvantage to do so.

Above the holes in the front of the bridge numbers should be painted, to indicate the value of the score. The order of the figures in different boards is not always the same, though they are never arranged consecutively. The highest and the lowest figures, viz., 9, 2, are, for obvious reasons, placed next to each other, and generally, if not invariably, in the centre. I am not aware whether there is any recognized rule for the arrangement, but the following may be taken as the sequence of the figures, reading from left to right, 6, 4, 7, 9, 2, 5, 3, 8. In this it will be seen that, roughly speaking, a high and a low figure alternates, the extremes being the two nearest the centre. The way in which the figures are shown must be left to the taste and skill of the worker, who need hardly be reminded that they may be gilded, or ornamented in a variety of ways.

The bridge, for the sake of appearance, should be French polished, though this need not be finished so finely as in an ordinary piece of furniture. Polishing may be omitted, but for the slight amount of extra trouble it will be more than commensurate in appearance, and do away with the slovenly look of unfinished wood work. Nothing has been said about the kind of wood to be used, as the maker may safely be left to his own discretion, which, as most bagatelle boards are made of mahogany, will show him that this is the most suitable material for the bridge. There is, however, no reason—except appearance—why any other wood should not be used, and having said this much, further comment or direction seems superfluous. Should any young or inexperienced worker meet with difficulties in understanding the construction, I will endeavour to remove them through the medium of the Council pages.

## THE CYLINDER ELECTRICAL MACHINE.

By JNO. H. MILNE.

II.—THE PRIME CONDUCTOR—THE CUSHION—FITTING THE HANDLE, ETC.—COST OF MACHINE—ELECTRIC CEMENT—AMALGAM—METHOD OF APPLYING AMALGAM.



THE prime conductor, Fig. 5, comes next in order. Cut about 5 or 6 inches from the broom-handle, fix another wooden rod about  $\frac{1}{2}$  inch diameter, and 4 or 5 inches long (B) at right angles to it, by making a hollow in the end of the first at A. Then carefully round the ends so as to prevent all sharp corners, and evenly cover the whole with tin-foil, which must be carefully glued on.

A row of brass, or ordinary pins shortened to  $\frac{1}{2}$  inch, can be inserted, as in the diagram. These will take the place of the points, in the more expensive machines.

A hole should now be made in the middle of A, at c, and a piece of glass rod fixed in it. The other end of the glass rod must be fixed in the stand, so as to allow the row of pins to be close to and parallel with the bottle, but without touching it.

It is convenient to allow the points of the prime conductor to be brought nearer to, or

removed farther from, the cylinder. This can easily be done by fixing a block of wood on the end of the glass support, with a hole through the centre, and lined with silk or some material which will allow A (Fig. 5) to slide through, and so prevent the tin-foil being scratched. Or a tube made of cardboard or several overlappings of strong paper, can be glued to a piece of wood fixed to the glass rod.

The glass leg can be made to fit tightly into a hole made in the stand, so as to be removable at pleasure.

The cushion will now have to be made.

A piece of wood will be required, say, 2 inches broad,  $\frac{1}{2}$  inch to  $\frac{3}{4}$  inch thick, and about 5 inches long, the same length as the cross piece, with the pins inserted, belonging to the prime conductor. The ends and edges should be rounded, to prevent the escape of electricity, Figs. 6 and 6 A.

Tack on a piece of silk, so as to make a loop or bag, close the one end, and then evenly stuff the cushion with well-dried wool, or better still, horsehair. A better effect will be produced by a mixture of horsehair and very fine iron wire. The kind used by florists for binding flowers, a considerable quantity of which can be got for 4d.

Procure a piece of wood, c, about  $1\frac{1}{2}$  inches broad, and about the height of the bar connecting the side supports. Fix it in the position marked c, c, Fig. 7, by screwing an ordinary brass hinge to the base, at d, and to the upright piece. Then screw on the cushion to the upright by a screw through the upright, and into the wooden back of the cushion, so that the cushion will press exactly on the centre of the bottle, Fig. 7.

It will be now seen that the hinge is a simple contrivance for regulating the pressure of the cushion against the glass cylinder, and for allowing the cushion to fall back when it requires the application of amalgam.

A flap of silk is now to be tacked on to the top of the cushion (Figs. 6, 7, 8) so that the flap corresponds to the breadth of the prime conductor and cushion, leaving a space of clear glass at each end of the bottle (D, D, Fig. 8). The flap should lie evenly over the bottle from the edge of the cushion, and terminate about

1 inch above the pins of the prime conductor. Now coat the exposed parts of the bottle between the uprights and the flap, with shellac varnish, in order to prevent the dispersion of electricity, also coat the glass support of the prime conductor.

It is of the utmost importance that everything used in the construction of the machine should be perfectly dry, and this must be specially observed in reference to the cylinder.

Machines of this class, of the most expensive description, have been utter failures, merely from there having been moisture in the cylinder when constructed.

In order to obviate this, electricians formerly coated the inside of the cylinder with a resinous cement.

It would be advisable before finally fitting the handle, to thoroughly dry the inside of the bottle, and coat it with shellac varnish, which will dry almost immediately. This can be easily done by putting some varnish inside the cylinder, and turning the latter round till the glass is coated, then drying with gentle heat.

A strong band of indiarubber should be fastened to the top of the rubber support, *c*, and also to the cross piece, *e*, so that the cushion may be made to press closely against the bottle, Figs. 7 and 9.

If preferred, a brass wire with a screw thread can be put through *e*, and the top of *c*, so that the pressure can thus be regulated.

A piece of brass chain or copper wire is fixed to the back of the cushion, the other end is allowed to lie on the ground, or is fastened to a gas-pipe when the machine is in use.

The machine is now finished. It need not cost more than 1*s.*, or even that amount, if made in plain wood.

If hard wood be used, and French polished, it will, of course, be slightly dearer, perhaps 2*s.*, but it will look neater.

A coat of copal varnish will do instead of French polish; or even shellac varnish, which is made by dissolving shellac in methylated spirits.

Glue not being the best adhesive, on account of a possibility of inducing moisture, the following electric cement is often used: Melt to-

gether, resin, five parts by weight; beeswax, one part; red ochre, one part; plaster of Paris, one-eighth part. The composition should be stirred when used, and be kept at about melting point.

Prior to using the machine, the rubber is coated with a composition known as electrical amalgam, which greatly promotes the production of electricity. There are many recipes for it. One (Higgins) is zinc, 1, mercury, 4. Another is (Kienmayer), tin, 1, zinc, 1, mercury, 2.

The usual method of manufacture is as follows: The tin and zinc (1 part each) are melted in an iron ladle, and well stirred. The mercury is at the same time heated. The latter is then poured into a small wooden box, through a hole in the lid. The heated tin and zinc are now poured in, and the hole corked up. The box is well shaken till the composition is cold.

The amalgam is then broken up into a fine powder, and is ready for use. It is of a silvery appearance.

Sir W. S. Harris, F.R.S., in his book on Electricity, gives the following recipe for an amalgam, which he says may be relied on: Pure tin and zinc are to be carefully weighed out, and put into a covered earthenware crucible, or into a clean covered iron ladle. The zinc should be first heated, and when about to fuse the tin added. In the meantime the mercury is placed in a separate crucible, or small iron ladle, and heated to something above the boiling point of water.

When the zinc and tin have become fluid, they may be removed from the fire, and the mercury poured on the combined metals, stirring the whole at the same time with a clean iron or steel rod.

We must, however, allow the melted metals to cool a little, for if the mercury be poured upon the alloyed tin and zinc at anything like a red heat, it may be driven into vapour before amalgamation takes place, and this vapour not only occasions a loss of mercury, but is very dangerous to inhale.

The exact time when to add the mercury is a nice point in the process.



The amalgamated mass is now allowed to cool further, and is poured into a wooden box. The box should be kept in a constant state of agitation, by shaking until the contents are cold.

The powder is now rubbed down in an iron mortar, and passed through a fine muslin sieve, and then set by in a closed wide-mouthed bottle, or a clean covered box, for future use.

He proceeds to state that if the amalgam

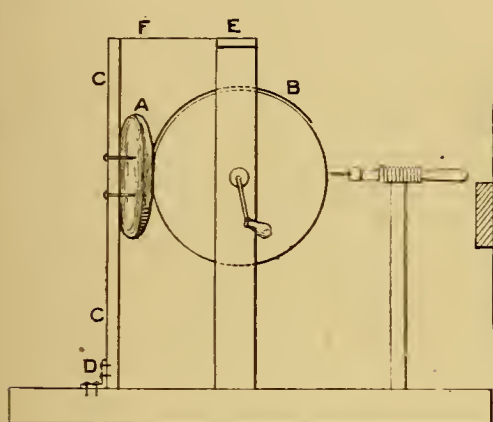


FIG. 7.

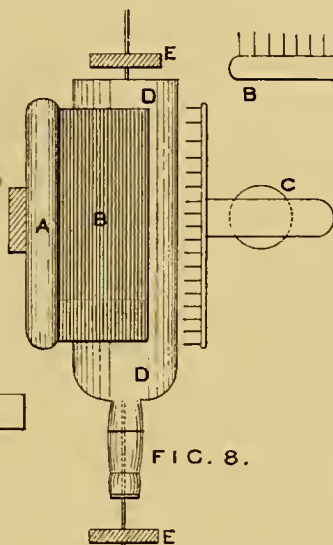


FIG. 8.

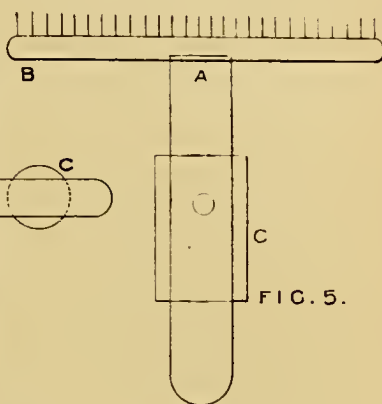


FIG. 5.

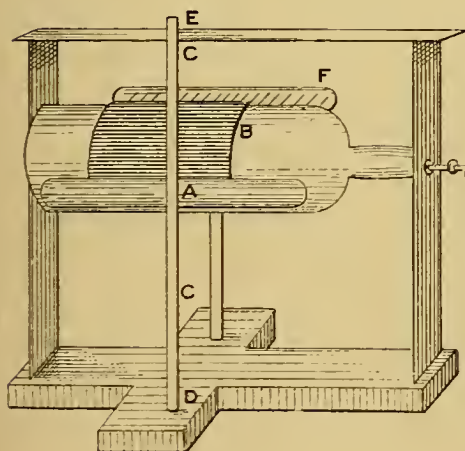


FIG. 9.

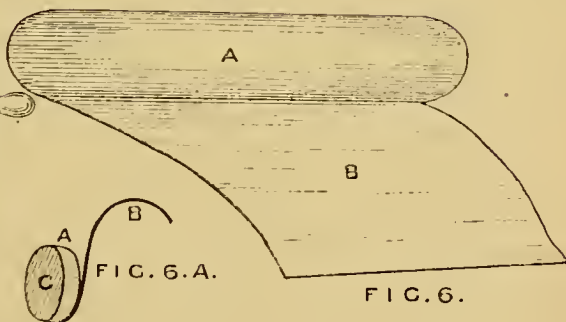


FIG. 6.

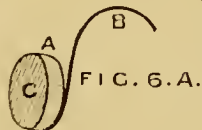


FIG. 6.A.

FIG. 5.—THE PRIME CONDUCTOR. FIG. 6.—PLAN VIEW OF CUSHION WITH FLAP ATTACHED—A, Cushion; B, Flap. FIG. 6A.—SECTION OF FIG. 6, showing, A, Cushion; B, Flap; C, The rounded Wooden Back to which Cushion is attached. FIG. 7.—END ELEVATION OF ELECTRICAL MACHINE—A, Cushion; B, Flap; C, Upright carrying Cushion; D, Hinge; E, End of Strip of Wood connecting the two uprights; F, Elastic Band or Screw for Regulating Pressure of Cushion. FIG. 8.—PLAN VIEW OF ELECTRICAL MACHINE—A, Cushion; B, Flap; C, Support of Prime Conductor; D, Parts of Bottle to be coated with Tin-foil; E, End uprights. FIG. 9.—PERSPECTIVE VIEW OF ELECTRICAL MACHINE—A, Cushion; B, Flap; C, Upright carrying Cushion; D, Hinge; E, Cross-piece connecting uprights; F, Prime Conductor.

If the amalgam does not contain a large quantity of mercury, it will commonly be found as a fine black powder, which is a proof of the success of the operation.

contains a larger amount of mercury (say, zinc, 1, tin, 1, mercury, 6), it will be of a bright colour, and that he found, after a source of experiments, that the best amalgam is in the

following proportions : tin, 1, zinc, 2, mercury, 4. Lastly, it should be observed that there are two ways of putting the amalgam on the cushion. It can either be mixed after being powdered, with sufficient lard to give consistency, and spread evenly over the cushion, or the cushion can be smeared with lard, and then the powdered amalgam passed through a fine sieve on it.

The amalgam must not be spread on the flap. The precise action of the amalgam is not quite agreed upon, although it obviously causes more electrical excitation.

It must be remembered that the machine must be preserved from dampness, and while in use the glass part should be frequently rubbed with a warm silk handkerchief, to prevent damp. The theory of the action of the machine is as follows : When the cylinder revolves, the electricity of the plate is split up, the negative electricity escapes by the cushion and chain to the ground but the positive goes to the glass. The positive then attracts the negative of the prime conductor thus neutralizing the electricity of the glass and charging with positive electricity the prime conductor, which is insulated, and the electricity so retained.

The positive electricity of the prime conductor discharges itself as a spark when the finger is applied to the end of the conductor.

#### WOOD VARNISH TO RESIST BOILING WATER.—

Boil 3 lb. of linseed oil in an untinned copper vessel. While boiling, suspend in the oil a bag containing 6 oz. of minium and 10 oz. of litharge, both finely powdered, so that it will not touch the bottom of the vessel. When the oil has acquired a deep brown colour, take out the bag and replace it by one containing a small piece of garlic. Melt 2 lb. of yellow amber with 4 oz. of linseed oil, and throw into the vessel. Let the whole boil for about four and a-half minutes, stirring well. After it has rested awhile, decant it ; and, when cold, pour it into stoppered bottles. The wood having received the necessary colour, and having been properly polished, four coats of the above should be laid on with a "fine sponge."—*Furniture Gazette*.

## FITTING UP A WORKSHOP.

By REV. ALGERNON THOROLD.

### II.—A SHOP ON THE "LEAN-TO" PRINCIPLE—SIZE OF SHOP—ESTIMATE FOR WOOD.

**N**OW, of course, it must not be supposed that no expense is to be incurred over our enterprise. Things are great and small only by comparison ; but, comparatively, our shop will be cheap, indeed, to what it must be, if erected on usual lines and in the usual way. Any one who has ever employed a bricklayer knows how cunningly he runs up his bill, sand, mortar, bricks, cement, and so on, over a page or two ; the carpenter is as bad with time and nails as the burden of his song. But when time and nails, excepting our own, are not in the bill, and no bricks or mortar are required, the chief items of expense are forthwith eliminated. In setting to work to build our paper workshop, a few points are first to be considered. How large shall it be ? Is it to stand in a corner, where two walls can be pressed into our service ; or must it have four sides of its own ? What position will be best adapted for light, and is it more likely to be a temporary or permanent erection ?

The table of probabilities tell us that if there is a garden, then also there will be a wall, and, further, that the wall will surround the garden. Under these circumstances, it is probable enough that the plan most likely to be adopted will be that which will enable the would-be possessor of a workshop to make use of the side and end walls, since this will lessen the work, and, therefore, also diminish the cost of the work by nearly one-half.

The first description, therefore, shall be of a shop built on the lean-to principle ; but here the question arises, To whom does the wall we have selected belong ? It is, I believe, a fact, that each householder can lay claim to one of the side walls which surround his garden or yard. Proceed, therefore, to find out which wall belongs to you, and let your shop be there. If, however, there are strong reasons for selecting

the other wall, and most probably there will be, as things have such a wonderful way of going by contraries, call upon your neighbour, and tell him you are anxious to make use of the top of his wall. Explain that you only require a short length at the corner, and interest him, if you can, in your project. In all probability he will civilly agree to your proposal at once; unless you have in former times served him with any bottles, or any other odds and ends with which having finished, you may have been unable to find other use than a charitable distribution of your goods for the benefit of others. Then, probably, he will deny you. However, be sure that you do not proceed without leave to erect any part of your shop on the wall which does not belong to you, lest when the house is complete, you are frigidly requested to remove it at once as a trespass.

Having received the permission we require, our next step must be to ascertain the height of the wall. Probably here we shall meet with our earliest disappointment. We require a wall nine or ten feet high at the back of the house, but it is unlikely that we are so fortunate as to be divided from our neighbours' cats by such a barrier as that. Five or six feet is the usual height, sometimes even less, and of which, unfortunately, most cats think nothing. After this, we must come to a definite conclusion respecting the size, that is, the length and breadth and height of our shop. If the garden is of convenient dimensions, we need not be very sparing in these particulars, so we will suppose that room is not a primary consideration, but that we can take as much as we are likely to want.

Twelve feet in length and nine feet in breadth will not be too large at all; with such measurements we shall have space to turn round, and the bench will not take up the ground over much. Of course, if we please to increase these figures, so much the greater will be our convenience, while the extra cost will be hardly felt. Now let us take our pencil and paper and rule in hand, and go somewhat carefully into details. It is to be remembered that cost is an object, we must not, therefore, go too magnificently to

work, but order just as much wood as we shall really require, or very little more.

We can always add to our store; but when once it is ordered the bill is a certain, and often a disagreeable consequence. Our first measurements, therefore, shall be along the wall for the wall-plate. Fig. 1 will show the sort of thing which will be needful here.

We will decide that the back of the shop must be 9 feet, and as our wall is not this there is nothing left for us but to supplement it. This we must do by making a light frame, Fig. 2, which we may either fill with glass or cover with paper. This frame will stand upon the wall-plate, *s*, and against the back of the head, *r*, and the uprights, *c* and *e*, in Fig. 4. The width of the brickwork is 9 inches, our wall-plate may therefore be 5 in. by 2 in. scantling; the head, or upper part of the frame and the intermediate uprights, will, of course, be the same.

If our shop is to be 12 feet long, and the wall is to be heightened by 4 feet, we shall require 40 feet of scantling for this first frame. For a building 12 feet in length and 10 feet in height, a width of 9 feet, as we have already said, will not be too great.

We may now proceed to take the ground measurements. For the foundation of the house we shall require an oblong frame, such as is shown in Fig. 3. This will add another 60 feet of wood to our estimate. Fig. 4 shows the entire skeleton of the shop; *a* and *b* is the foundation frame already spoken of; *c* is an upright from this foundation to the top of the back frame, 10 feet high; *d* is a similar one for the opposite corner, and is, of course, the same height; *e*, *e* are two uprights for the front, 6 feet 6 inches high; *f* is an upper sill upon which the lights, *g*, *g*, rest, and is the full length of the building, that is, 12 feet; *h* is an upright between the lights, 3 feet long; *k*, *k* are uprights below the sill, 4 feet 6 inches in length; *l*, *l* are cross-pieces, from the upright, *c*, to *e*, and above the door, 9 feet in length; *m*, *m* are uprights from the side sill to the roof, each 10 feet long; *n*, *n*, *n*, *n*, *n*, are rafters from the back frame to the front, each 12 feet long;



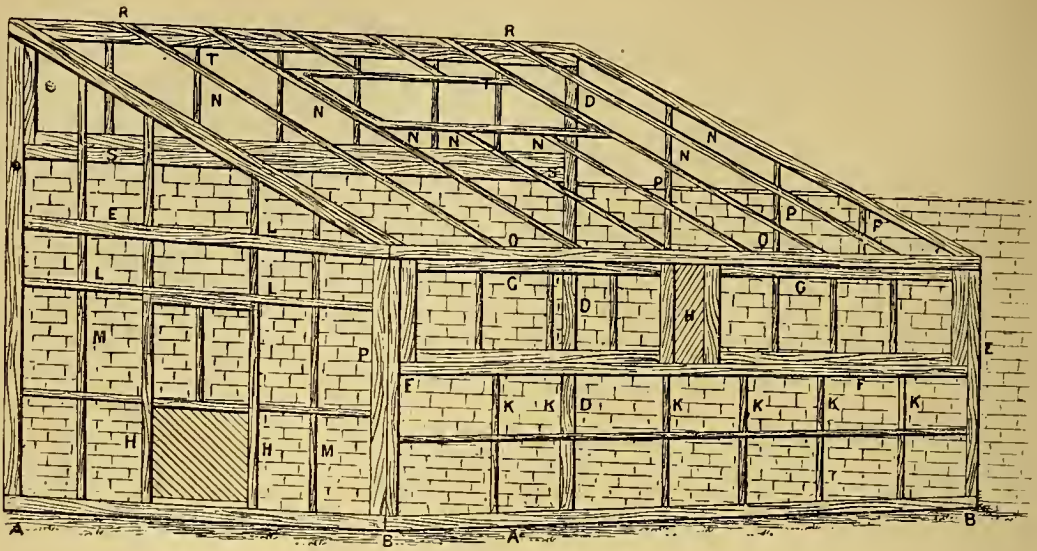


FIG. 4.—FRAMEWORK OF STRUCTURE.



FIG. 1.



FIG. 2.



FIG. 3.

FIG. 1.—WALL PLATE. FIG. 2.—LIGHT FRAME TO BE COVERED WITH WOOD OR PAPER. FIG. 3.—FOUNDATION FRAME.

o, o is the upper sill of the front, between which and f the lights are hung, this is 12 feet in length; r, r is the head batten of the framework of the roof, upon the back of which the lights, t, t, spoken of before, are fixed; r, r will, of course, be of the same length as the front of the house, 12 feet; p, p are strips for the triangle between the end wall and the roof, for which we must add 18 feet. This will complete our list; but for safety, we will, in adding up our figures, allow for another 20 feet in case of accidents.

Our list will then be—

|                                    |                         |
|------------------------------------|-------------------------|
| Scantling for wall-plate . . .     | 13 ft. 5 in. by 2½ in.  |
| Ditto for ground frame . .         | 60 ft. 5 in. by 3 in.   |
| Ditto for back frame . . .         | 40 ft. 8 in. by 3 in.   |
| Ditto for skeleton of house .      | 100 ft. 3 in. by 2½ in. |
| Lighter scantling for cross strips | 150 ft. 2 in. by 2½ in. |

With respect to the door, it would be better to purchase it than to attempt to make it, and in this we shall have no difficulty on application to the Cheap Wood Company, of *Bishopsgate Street, E.C.*, or any other dealer in timber. The same remark may be here applied to the front lights which we shall require, and which will be spoken of presently. The frame of the door and lights will require some nicety of workmanship, and without a shop or bench it will be quite useless for us to attempt them.

We have now found out the quantity of wood, in the aggregate, that we shall require for the skeleton of our shop; but, of course, as it comes from the timber-yard, it will be in its rough state as sawn out. To many large timber-yards there is attached a planing machine, and we shall do wisely in having our scantling run through it; but if there is any difficulty in this, we must be satisfied to leave the greater portion of the framing rough, and get the nearest carpenter to run over the uprights of the door, also r, h, and o.

(To be continued.)

## HOW TO MAKE AN ELECTRO MOTOR FOR DRIVING SMALL MODELS.

By ELECTRON.

### II.—WINDING THE ARMATURE—TESTING—WINDING THE FIELD MAGNETS—FITTING.

ONE of the bearings is  $\frac{3}{4}$  inch longer than the other, this is for fixing the brush block, and must be fixed at the same end as commutator, with the projection on the top side; Fig. 5 shows this bearing. The wire for winding the armature and field magnets, is cotton-covered copper wire, No. 20; about five ounces will be required.

The armature must be taken out of the bearings for winding, the bearings having first been marked, so that they come into the same places again.

Cover the inside of channels in armature, and the spindles as far as the wire will reach when wound, with tape glued on, to insulate the wire from the iron, the wire should also be examined to see that none of the covering is damaged, should any be damaged, it should be repaired by wrapping fine cotton thread round the place; commence winding the armature at the left-hand corner, at the end where commutator is fixed, winding from you over the web; wind the channel on that side of spindles till full, then cross over spindles, and wind the other side till full, and bring the end of wire along the underside of web, and tie the end, as much wire

must be left projecting at each end as will reach to the commutator. The covering must be stripped off each end, the ends of wires cleaned with emery cloth, and soldered to opposite sides of the commutator, as close to the inner edge as possible, and leaving at least  $\frac{3}{8}$  inch on the edge of commutator clear for the brushes. The wire must be closely and evenly wound, and each coil gently flattened down with a piece of smooth

wood, the wire must not be allowed to project beyond the edges of the armature, or it will catch in the field magnets. The winding of the armature must be tested two or three times during winding, in the following manner: connect one end of wire on armature to a galvanometer, connect the other binding screw of the galvanometer to one pole of a bichromate battery, connect a wire to the other pole of battery, and

touch the turned part of armature with the end of the wire; should the needle not be deflected when the wire is in contact, the winding is right, should there be a deflection, there is some fault in the covering of wire or of the armature, and wire must be unwound, till the fault is discovered, and put right.

Commence the winding of the field magnets at the left-hand end of the top limb, the ends of magnets being at the right hand, find the centre of the wire left from the armature, and wind over the top from you, winding it as

closely as possible, and flattening each coil with a piece of wood; wind five coils on each limb, making the upper coil a little shorter than that below, so that it is of a conical shape when finished; the coils can be kept to the conical shape by inserting a piece of narrow silk ribbon under each coil, and turning the ends over, so that the next coil fastens it. After the top limb is wound, carry the wire over the lower limb at the left-hand end, and bring it

up and over the top side of lower limb, winding from you, wind this the same as upper limb, and tie the ends, leaving a few inches projecting for the purpose of making the connections, see Fig. 6.

The winding of the field magnets can be tested in the same manner as the armature, touching the inside of hollowed ends, to see if there is any deflection of the needle. When.

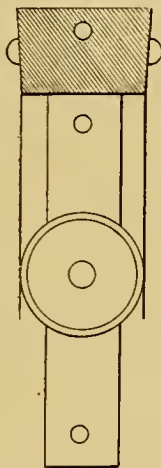


FIG. 5.—BEARING WITH BRUSH BLOCK AND BRUSHES.

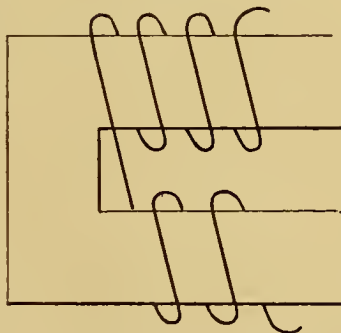


FIG. 6.—METHOD OF WINDING FIELD MAGNETS.



the magnets are wound, and the ends of the wires connected to a battery, one pole should be north, and the other south, which can be tested by bringing a small compass near each pole, the north pole of magnet will attract the south end of compass needle, and the south pole the north end of needle.

A base-board of mahogany must be made, about 6 inches by 4 inches, the edges should be moulded or chamfered, and four small feet fixed underneath; it should be French polished or varnished.

Drill holes in each foot of field magnets, and screw them to centre of base-board by two round-headed screws.

Prepare a block for brushes, of dry boxwood, which should be well soaked in melted paraffin wax, it should be a little wider than the diameter of commutator, and  $\frac{3}{8}$  inch thick, it should be made rather narrower underneath, so that when the brushes are screwed up they will press on the commutator, the brushes are made of two pieces of thin springy brass  $\frac{3}{8}$  inch wide, and should reach from the top of block to a little below centre of commutator, a slit  $\frac{1}{16}$  inch wide is filed in the centre of the lower end of each, and a hole is drilled in the top ends of each, through which they are screwed to the block by short round-headed brass screws, these screws must not touch each other; the block is then screwed to the top of long bearing, this screw must also be kept clear of the two screws passing through brushes. Fig. 5 shows the brushes fixed in position.

A driving pulley must next be prepared, it should be about  $\frac{3}{4}$  inch diameter, and turned out of a piece of brass, or hard wood, with a V groove in the edge, it must be fixed on the spindle of armature outside the bearing, at the opposite end to the commutator, it can be fixed by a small key driven in; care must be taken that it runs truly.

Fix two binding screws on the base-board, at the end next armature, fix the bearings, armature, and brushes, on the field magnets, see that the armature runs easily, and that the brushes press evenly on the commutator, then connect the wire from one end of field magnets to the

top part of one of the brushes. The wire covering must be stripped off the end of the wire, and the wire cleaned by a piece of emery cloth, turn the end of wire into a small loop and fix it under the screw holding brush to block, having the wire outside, then bore a small hole in base-board, and bring the wire from the other end of field magnets to the underside of the base-board, strip and clean the end, and solder it to the underside of one of the binding screws; the other brush is connected to the remaining binding screw by a short piece of wire having a loop formed at each end. If the two binding screws are connected to two pint cells of a bichromate battery, the motor will revolve at a great speed, and, with three cells, will drive any light model, connected by a belt to driving pulley.

For amateurs who are constructing, or intend to construct, working models on a small scale, of any invention they may have in view, this little machine will be found a very convenient motor. In fact, all who wish to exhibit machinery in motion on a miniature scale will find it a useful and convenient means of supplying the necessary motive power, as well as affording a valuable exercise in the construction of electrical apparatus.

If I have not made everything quite clear and any reader would like to have any point explained more fully, I shall be pleased to answer any questions and give all the information in my power through the medium of "Amateurs in Council."

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**PLASTERING OUTSIDE BRICK WALLS.**—The following is a good recipe for plastering on the outside of a brick wall: Take of slaked lime, 60 parts; sand, 35 parts; litharge, 3 parts; knead and work the ingredients into a stiff mass with 7 to 10 parts of linseed oil; use old oil or linseed oil varnish. It should be well worked to the consistency required and applied as other mortars, well trowelled down. Or, sand, 90 parts; litharge, 5 parts; plaster of Paris, 5 parts, moistened and worked together with a small portion of linseed oil. Oil the brick three coats before applying the cement, and trowel down.—*Builder and Woodworker.*



## A BABY'S WALKING CHAIR.

By REV. J. L. DWYER, B.A.



IN former numbers of *AMATEUR WORK* I was permitted to describe "A Folding Cot," and "Simple Baby's Chair." Another article requisite for the muscular development of our youthful progeny I will endeavour to describe in this present paper, and that is a Walking Chair.

I was never much of an advocate for this particular contrivance for teaching children to walk, and it was somewhat under compulsion that I made it; but, now that I have seen its practical effect, I have come to the conclusion, like Sir Roger de Coverley, that "Much can be said on both sides."

I resolved, however, that mine should differ from the stereotyped plan, in having a larger base, and, therefore, be less liable to tumble over in case the holder should stumble in the serious business of learning to walk.

For the sake of those who have never seen one, I may explain that a walking chair in no way resembles a real chair. It is, in fact, simply a light frame mounted on three small wheels, with a handle erected from it at such a height that the child could easily hold on to it, and push the chair before him, leaning on it, while he toddles forward. Fig. 1 is a perspective view of my construction, and will give a fairly good idea of the general appearance.

All the lower part is made of deal, 1 inch thick and 2 inches wide, the side pieces are 30 inches long, the connectors 21 inches and 7 inches respectively. The handle and its supports I made of oak; but any wood, even deal, would do almost as well. The entire cost did not exceed sixpence.

For the lower framework, plane up the stuff and cut it to the lengths indicated, viz., two pieces  $2\frac{1}{2}$  feet long, one 21 inches and one 7 inches. Then draw a full size plan on a table or the workbench. First draw two lines square with the front edge of the table, 2 feet 3 inches apart, then draw a line parallel to the edge and 2 feet away, this will give a rectangular figure like that seen in Fig. 2; then draw two lines at

one end, equidistant from the edges and 1 inch apart, b, b, Fig. 2; then draw lines from these lines to the corners, to represent the sides of the frame, they being 2 inches apart, and in such a way that the bevelled parts, a, a, a, a, will take off an inch of the ends, leaving the other inch square. Lay the sides on these lines and with a straightedge mark the bevels, a, a, a, a, and cut them off with the tenon-saw, give a touch of the plane to smooth down the saw marks, then place the side pieces on the bench again along the side lines; lay the cross-pieces on top of them in the positions indicated, and secure together with  $1\frac{3}{4}$  inch screws, two at each end. If anyone wishes to go to extra trouble, he might mortise the parts together, but I question whether it would be any advantage.

Now for the handle, which is placed perpendicularly over the long cross-bar. It is a foot long, and of oak, 1 inch square, but, as I said, a softer wood would be almost as good. I turned mine very neatly, as I thought it would be pleasanter for the little hands. The supports are 15 inches long, and mortised into the handle and cross-bar, they straddle somewhat towards the lower end, being 4 inches apart on top, and 7 inches at the bottom. My supports are  $\frac{3}{4}$  inch square, with the corners just planed off.

A long strip of oak connects the top of the front cross-piece with the centre of the handle, being fastened with a couple of wire nails to each, and it gives rigidity to the handle.

It is all finished now except for the wheels. These are 1 inch thick and 3 inches diameter. I turned them from a piece of hard wood, which is, I think, the best plan; but, when I was a boy, I cut many a wheel from a piece of board, marking it with a compass, and cutting the wood off to the mark with a chisel. A pin of  $\frac{1}{8}$  inch wire passing through the sides secures the front wheel, while the side ones are secured by stout 2 inch screws, which act as axles. A coat of enamel will enhance the appearance very much, and make it of additional value to the little one for whose use it is intended. As I said before, I was doubtful of the efficacy of a walking chair, but my daughter, who would

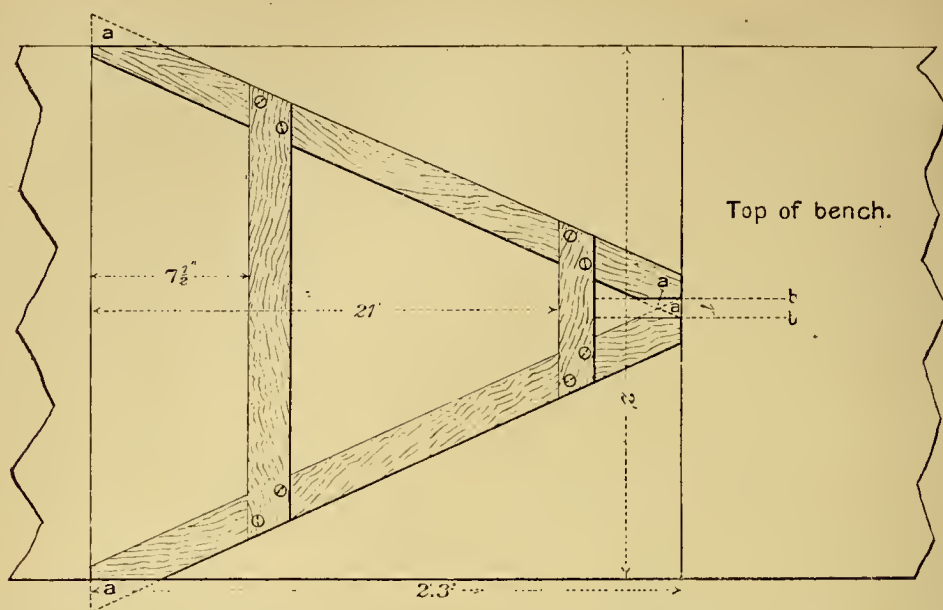


FIG. 2.—TOP OF WORKBENCH SHOWING PLAN OF CHAIR.—a, a, a, a, Bevel of Side Bars; b, b, Lines  $11\frac{1}{2}$  inches from Sides for Setting out Front Bevels.

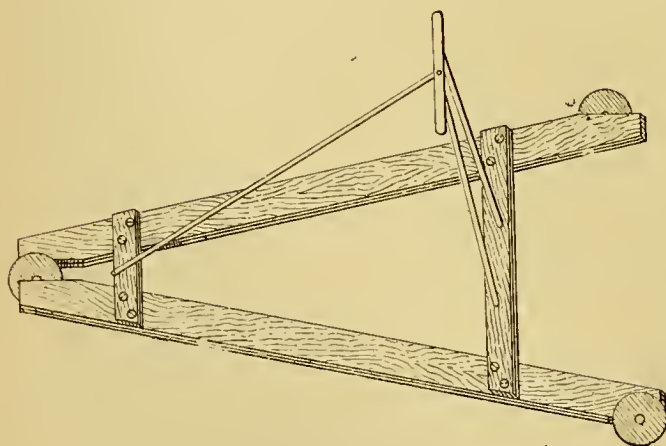


FIG. 1.—PERSPECTIVE VIEW OF WALKING CHAIR.

not take a step by herself on any account, walks about the avenue most majestically with the aid of the chair.

My arrangement differs from others, chiefly in having the hinder wheels so far back. They are mostly placed at the ends of the long cross-bar; but then, the slightest pull would turn it over at once to the disgusted astonishment

of the small individual who condescends to use it.

My plan is very stable, and since the centre of gravity falls so far within the base, I do not think an upset is possible by any ordinary means.

The construction of the whole affair is so exceedingly simple that I do not imagine anyone will require more particulars than I have given, but if so, please apply through "Amateurs in Council."

**HYDROQUINONE DEVELOPER.**—A correspondent in the *Amateur Photographer* gives the following formula:—

Hydroquinone, 40 grains; Carbonate of potash, 120 grains; Sulphite of soda, 160 grains; Water, 8 ounces.

Three or four ounces of the above will develop half-a-dozen half-plates, and may be returned to the stock bottle when done with.

## A DAYLIGHT ENLARGING APPARATUS.

By ED. C. ROE, Jun.

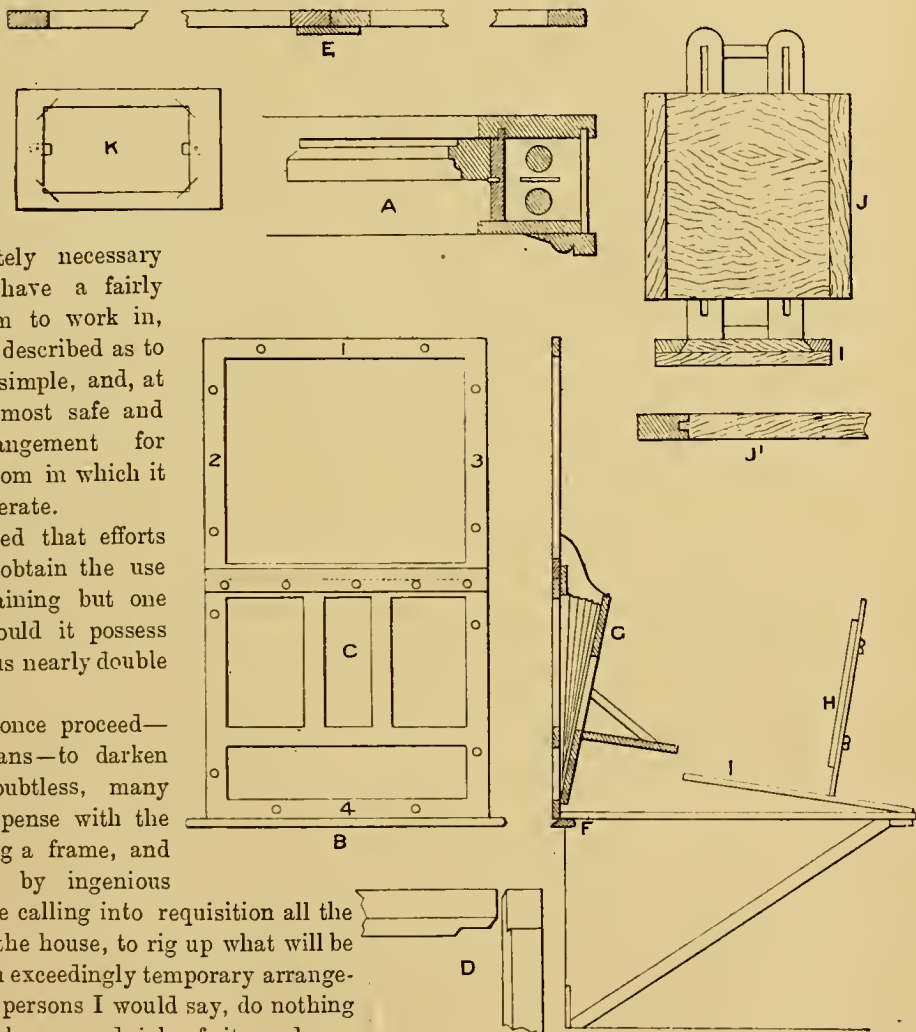
**I**N the following paper I shall endeavour to explain an easily constructed, and, at the same time, a perfectly serviceable arrangement for enlarging, by means of daylight. It will be assumed that the intending operator has no large dark room at his disposal, and as it is absolutely necessary that we should have a fairly roomy dark room to work in, a method will be described as to how to fit up a simple, and, at the same time, most safe and convenient arrangement for darkening the room in which it is proposed to operate.

It is presumed that efforts will be made to obtain the use of a room containing but one window, as, should it possess two, it will give us nearly double trouble.

We will at once proceed—by suitable means—to darken our room. Doubtless, many will try and dispense with the trouble of making a frame, and will endeavour, by ingenious methods, and the calling into requisition all the odd blankets in the house, to rig up what will be at its best but an exceedingly temporary arrangement. To such persons I would say, do nothing of the kind, make a good job of it, and you may depend upon it that you will be well repaid for your trouble and exertions.

The majority of sashes and frames are made and fixed with the inside lining showing on face several inches between the bead and inner edge of the architrave which surrounds the window; this is shown at A, and it is upon this lining

that we shall fix our screen or frame, an elevation of which is shown at B. The size is, of course, conditional upon the sash to which it has to be fixed, but for the size of the stuff,  $2\frac{1}{2}$  inches by 1 inch will be found sufficiently strong. It will be seen that the frame is constructed in two parts, the top one being a simple



frame; the bottom one is slightly more elaborate, as provision has to be made for the entrance of light, the opening for the admission of which is shown at c. The whole of the framing may be halved together, as sketched at d, or may be mortised and tenoned, a description of which process, from constant repetition, may



be deemed superfluous. The whole is covered, with the exception of the opening, *c*, with black twill or canvas, stretched on, and then covered with brown paper by means of paste. A strip of stuff,  $4\frac{1}{2}$  inches by  $\frac{1}{2}$  inch, should now be fastened on to the bottom frame, thus covering the joint, as at *e*.

On the back of the four external laths, 1, 2, 3, and 4, must be tacked a strip of felt or other soft material, in order to afford a bed on which to fasten the frame, thus making the joint the frame makes with the lining light-tight. By the way, a small frame, made to fit the opening, *c*, and covered with ruby medium, is useful for many purposes when the opening is not required for enlarging. The frame being fixed up, it would be as well to cover the opening, *c*, up, and examine our handiwork for leakages of light. The size of opening, *c*, is, of course, governed by the size of the largest negative from which we wish to enlarge.

We must now construct our bracket, as shown at *g*, to carry the camera. Take a piece of 9 inch stuff, the length of which must be according to circumstances, and plane up; then cut a hole to fit camera back, hinge on to bottom rail of frame, as at *f*. At right angles to this must be screwed another piece, to form a shelf as it were, supported by two thin strips, as at *g*; this is to carry the camera. Through this we must bore a hole for the purpose of fixing the camera to shelf by means of the usual screw.

The arrangement for carrying the paper on which we wish to enlarge is shown at *h*. The horizontal shelf, which is fixed, should be about 3 feet long and 11 inches wide, and is fixed by means of a couple of screws on to the nosing of window frame, as at *f*, the other end being supported by means of two props or struts, which take bearing on the floor and skirting at one end, and at the other on a fillet screwed on to end of the horizontal shelf already mentioned. It would be useless to give any exact dimensions for this portion of the work, as in nearly every case the method of fixing will vary.

We now turn our attention to the easel to which we shall actually fix our paper. A piece

of board,  $\frac{1}{2}$  inch by 11 inches, will be required, properly prepared, as it is upon this our sliding arrangement will work. We shall observe, by referring to Fig. 1, that it is necessary to fix on the edges of our ready-prepared board two fillets, between which the base-board of the easel frame will slide; these pieces will need to be about  $1\frac{1}{2}$  inches wide on the top face and  $1\frac{1}{4}$  inches on the under face; one edge of each piece is bevelled, thus the variation in the width of the faces. Between these pieces we must fit very accurately another piece of board, about 12 inches long, bevelled on both edges, so as to slide fairly easily, but not loosely, between the two fillets.

The upright frame of the easel must now claim our attention. First, get out the two standards, which need each to have a slot cut in them; the pieces should be about  $2\frac{1}{2}$  inches by  $\frac{3}{4}$  inch, and 1 foot 6 inches long, and the slots  $\frac{3}{8}$  inch wide, cut along until within an inch or so of each end. It is now necessary to frame these together, perhaps the quickest way being to screw two fillets on the back of them; the fillets and their position will be seen on reference to Fig. 1. The frame thus made must be securely fixed to the sliding piece already prepared, care being taken to fix it square; the simplest plan is to screw it on from the underside—if this method be adopted, be careful to countersink sufficiently for the screw heads.

We next turn our attention to the board, which should be, say, 14 inches square; this should be clamped, as shown at *j*, for the purpose of preventing the board from twisting or curling; there are several methods of doing this, but perhaps the ordinary method of construction will answer our purpose. The material for the board should be 14 inches wide and 11 inches long, an extra inch being allowed from which to form the tongues, which will be seen in section at *j'*. The length between the shoulders, that is, 10 inches, should be set out on the face of the wood, and the lines cut in with a cutting-knife (a penknife is an excellent substitute). A mortise gauge is set to the thickness of the tongue, which will be the width of the plough-iron to be used, and the ends of

the stuff gauged; with the tenon-saw saw along the lines cut in the face of stuff down to the gauge lines; this is required to be done four times, and the result is really a short tenon on each end after removing the superfluous wood down to the gauge lines. We now proceed to prepare the clamps for the ends; these may be 2 inches wide, and gauged in the same manner as before, and the plough being set, grooves are ploughed out with the iron, according to which the gauge was set. If the work has been executed accurately, the clamp should fit easily on to the ends on which the tongues are, making a good joint with the shoulders, if not, the shoulders must be eased with a rebate plane; this being done, the clamps should be glued on with good, fresh-made glue, not glue that has been made hot a great number of times, as this cannot be expected to hold the work together properly; place the whole in cramps, and leave sufficient time to dry, after which clean off both sides, taking particular care to work straight all ways.

A rough-and-ready way of making a substitute for the above, is to obtain and screw on the back of the board, which in this case, must be cut net size, a couple of fillets, taking care to keep them clear of the slotted pieces.

At any ironmongery store we can obtain two  $\frac{1}{4}$  inch bolts, preferably with octagon or square heads, and fitted with wing nuts,  $2\frac{1}{2}$  inches long; these are for fixing the board to the slotted uprights. The heads of the bolts must be let in flush with the face of the board.

The end of this board and easel, when completed, should be hinged by means of a pair of strong butts, say,  $2\frac{1}{2}$  inch cast, to the horizontal fixed shelf; there should be no difficulty in fixing at any angle required, if we cut a rod and a few notches in the top of one, and the underside of the other, board.

We can now fix up our apparatus, but before beginning our experiments, must make provision for excluding the light between the opening in our frame, c, and our carrier, g; this is best done by obtaining a piece of black twill, preferably lined with another piece of canary coloured medium and fastening, first on to the frame, b,

and then to the edges of g, allowing a little slack for shifting.

The carrier, g, may be fixed at any required inclination by means of a cord or a wire fastened to b, by suitable means, and hooked or looped on to a screw placed in top edge of g. It will be found convenient if the black twill is allowed to lap over sufficiently to cover the joining of the camera and board.

Regarding the means of holding the negative in the camera, it can generally be arranged so that the dark slide, with both shutters drawn, will serve the purpose. If not, a frame must be made; an easy method of doing this is to halve four pieces of thin stuff together, on the outside to measure the same as dark slide, and the inside to fit negative proposed to be worked from, and which is held in place by means of four pieces of zinc at corners on one side, and by two slips on the other, as at k.

I do not think the arranging of a reflector on the outside calls for any special mention, further than, that it should be made sufficiently large, and, if possible, to have a cord running from the top through our screen into the room for shifting to convenient angles.

In writing this it has been my endeavour to give a general idea rather than explicit working instructions; in fact, were it so done, it would prove of little practical use, as the variation in size and situation of windows calls, in many cases, for special arrangements. However, a letter through "Amateurs in Council," containing particulars of any special case, shall have the strictest attention. I, therefore, conclude this paper, trusting that dabblers in the once-called "Black Art" may be able, through the medium of the above lines, to produce enlargements which will prove things of beauty, and, it is to be hoped, joys for ever.

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TO FILE DOWN A WASHER or thin piece of metal of small size: Lay the washer on a piece of soft wood, put the two between the jaws of a vice and screw up tight. On releasing them it will be found that the iron is neatly embedded in the wood which holds it securely until filed down to the required thinness.—*English Mechanic*.

## HOW TO MAKE A VERTICAL BOILER.

By ELECTRON.

**T**HE boiler about to be described is made of sheet copper, the joints being formed with brass rings, and riveted, in the same manner as the cylindrical boiler described in Part 10 of *AMATEUR WORK* (New Series). It is  $13\frac{1}{2}$  inches high, 7 inches diameter; the fire-box is  $5\frac{1}{4}$  inches diameter and 6 inches high, and the tube through boiler is  $1\frac{3}{4}$  inches diameter. The copper for shell and fire-box is  $\frac{1}{16}$  inch thick, and for crown of boiler and fire-box,  $\frac{1}{8}$  inch thick. The boiler may be made any size, to suit the requirements of the maker; but, if made larger, the strength of the copper should be increased proportionately.

Fig. 1 is a sectional view of boiler, drawn to a scale of half size. There are two cross tubes in fire-box,  $\frac{3}{4}$  inch diameter at one end, and  $\frac{1}{2}$  inch at the other end. The joint in the tubes is brazed. Commence by making the fire-box. Turn up the rings for top and bottom; the rings must be  $\frac{1}{8}$  inch thick when finished; turn the shell of fire-box in a pair of rolls, allowing joints to overlap  $\frac{3}{8}$  inch; tin the two overlapping portions, fix the rings on, and drill three holes, one at each end and one in the centre; put three small bolts in these holes, screw up tight, then drill between the bolts, and rivet up as described in previous article; take off the rings, and turn the ends true; then drill the rings, having scribed a line on each for centres of rivet holes. The lower flange of bottom ring is made  $1\frac{1}{8}$  inches wide, so as to join the ring on the lower end of shell, and the holes in this flange must be marked off, to coincide with the centre of ring at lower end of boiler shell.

Next cut out crown of fire-box to the size of top ring of same; also cut a circular opening in centre of crown, to fit the tube passing through

boiler, which is  $1\frac{3}{4}$  inches diameter; turn up the two rings to fix tube to crown of fire-box and boiler, and drill the holes in them for rivets; rivet one to opening in crown of fire-box, then rivet the rings to top and bottom of shell of fire-box, and rivet the crown of fire-box to top ring. The shell of boiler must next be turned, and the joint riveted; turn and drill the rings for top and bottom of same, also cut out crown of boiler, making circular opening in centre for tube, and rivet the ring to it. Rivet the rings on shell, and rivet the crown to top ring. In drilling the holes in lower ring of boiler shell, they must be drilled same as the holes in lower ring of fire-box, and the rings must be marked while being drilled, so as to come together in the same position when riveted. Before the crown plate of boiler is riveted on, solder to the

inside of it two circular pieces of brass,  $\frac{1}{4}$  inch thick and  $1\frac{1}{2}$  in. diameter, and drill and tap them for safety-valve and steam-tap; the valve is  $\frac{1}{2}$  inch

diameter, and weighted to a pressure of 20 lbs. per inch. The steam-tap should be a  $\frac{3}{8}$  inch tap, with union.

Solder to the inside of shell two pieces of brass,  $\frac{1}{4}$  inch thick and 1 inch diameter, and drill and tap them for gauge taps, one being  $7\frac{3}{4}$  inches, and the other  $9\frac{1}{2}$  inches, from lower end of boiler.

Make the tube passing through boiler of drawn or brazed copper tube  $\frac{1}{8}$  inch thick. It should stand  $\frac{3}{4}$  inch above top ring, when fixed. Drill two holes in lower end, opposite each other, and fix it to ring on crown plate of fire-box by two small bolts; then set the fire-box on a level surface, and, with a square, set the tube truly vertical, and drill other two holes at right angles to the first two, and fix by two small bolts; then put on the shell of boiler, and see if the tube comes easily through the ring on crown of fire-box; should it be to one side, the bolts

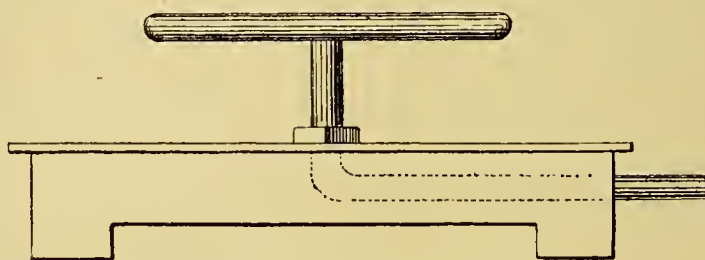


FIG. 4.—IRON STAND AND GAS RING.



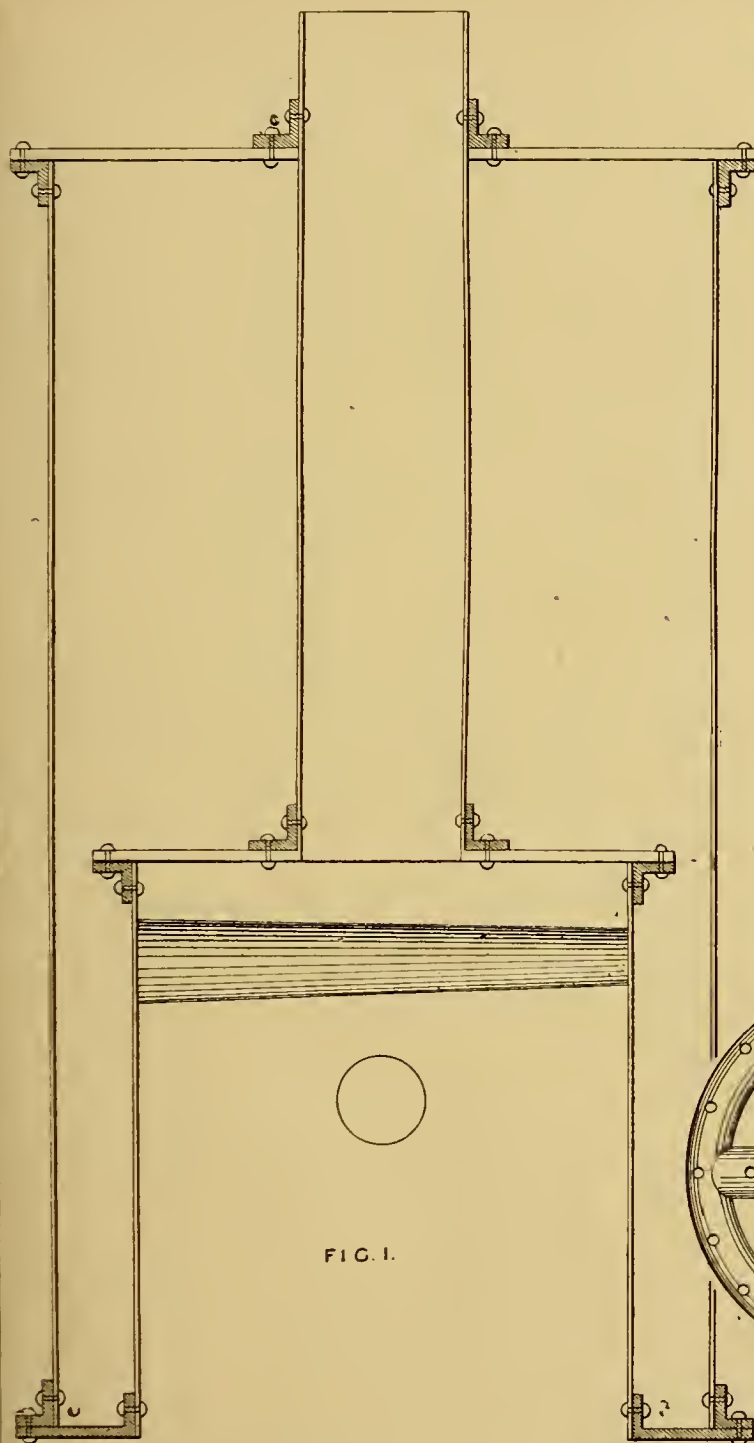


FIG. 1.

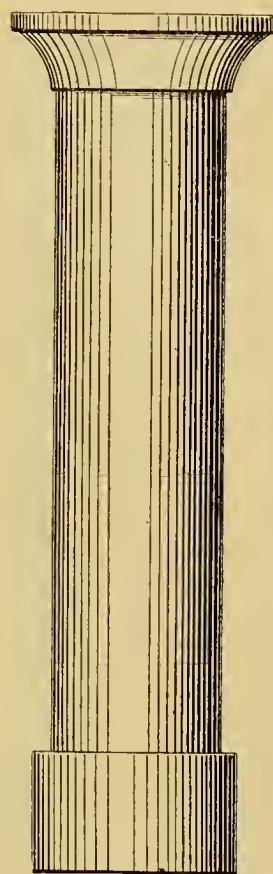


FIG. 2.

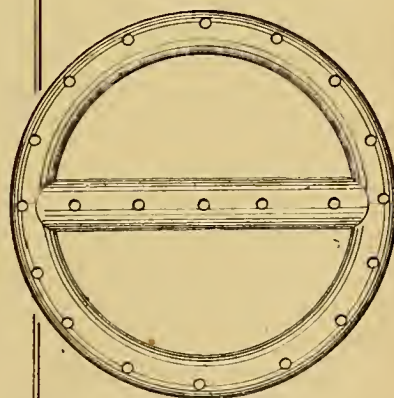


FIG. 3.

FIG. 1.—SECTIONAL VIEW OF BOILER, HALF SIZE. FIG. 2.—FUNNEL, HALF SIZE. FIG. 3.—GAS RING, HALF SIZE.

must be slacked, and the holes eased a little, till it passes through easily. Then drill the remaining holes, put in three rivets, take out bolts, and try shell on again. If the joints come together without any strain, finish the riveting of tube; but, if not, the rivets must be cut out and altered till they do.

Drill holes in shell of fire-box for cross tubes, at right angles to each other, making them a good fit; tin the ends of tubes and the outer edges of holes, and make a good joint, with a soldering-bit, round the outside, the tubes being made to project  $\frac{1}{8}$  inch at each end, so as to get a good joint.

The whole of the joints of fire-box, and inside of boiler shell, must now be gone over with a soldering-bit, being very careful to fill all joints and the edges of rings, as they cannot be got at after the shell is riveted on.

Next fix shell of boiler on fire-box, and put four small bolts on rings at lower end, then mark and drill the holes in top end of tube, through ring on crown plate, and rivet the tube to ring; also rivet the lower end of shell of boiler and lower ring of fire-box.

In all cases, after drilling holes, the burr raised on the edges must be filed off before riveting, so as to get the joints perfectly close together, and the inner faces of all joints must be tinned. After the riveting is finished, all the outside joints of shell and edges of rings must be gone over with a soldering-bit, and filled up; then clean off all superfluous solder, and clean the outside with fine emery cloth.

Screw in the fittings, using a little red-lead and oil for the joints.

A funnel, or chimney, must be made, similar to Fig. 2; the tube is the same size as the tube through boiler, with a brass cap riveted on the top, and a brass hoop on the bottom, turned up, and made to fix on top of tube through boiler. It may be 8 or 10 inches high.

Fig. 4 shows a stand of sheet iron, on which is fixed a gas burner for heating. A  $\frac{3}{8}$  inch copper tube is made into a ring, with a pipe across the diameter; this is screwed on a pipe coming from one side, and through the top of stand; holes are drilled in the ring, towards the

outside, so as to throw the flame against side of fire-box. Fig. 3 shows the top side of ring.

The stand for ring is sheet iron,  $\frac{1}{4}$  inch thick, about 9 inches square and 3 inches high. It is riveted together by four pieces of angle iron, at the corners, and four pieces to fix top. The pipe for gas passes in at one side, and through the top, as shown by dotted lines; openings are made at each side, and in the top, for the admission of air; an indiarubber pipe is connected to the pipe in side of stand, to supply the gas, which should be from a  $\frac{5}{8}$  inch or  $\frac{3}{4}$  inch gas pipe.

## A MODEL PUMP WORKED BY WIND POWER.

By REV. A. THOROLD.

### II.—THE FORCE OR LIFT-PUMP AND ITS ACTION— DETAILS OF CONSTRUCTION—CONNECTION OF PUMP AND SAILS—ARRANGEMENT FOR KEEPING SAILS BE- FORE THE WIND.



HE force or lift-pump with which we are immediately concerned in our model, is a combination of two principles, one of which enables us to draw water from a point below us, and the other to discharge it when drawn to a height above us. Fig. 2 shows a section of such a pump.

The second power is obtained through the arm at *e*, the water being raised in the ordinary way is not discharged as usual through the cock at *k*, but is passed on through the arm, *L*. On entering *L*, it rises with the stroke of the piston through the valve at *o*. Upon the downward stroke of the piston the water in *L*, also, naturally begins to descend, but is at once arrested by the simultaneous closing of the valve at *o*.

When the piston once more ascends the fresh body of water let into the barrel through the bucket is carried with it, and opening the valve, *o*, again, carries the water already in *L* to a higher level, occupying the place of what it has dispossessed, till in its turn it is also forced upwards by a third stroke of the pump. This action being continued, the water at last over-

flows the top of *L*, and the tank into which it discharges itself is gradually filled by the successive jets of water through *L*.

The action, however, of this sort of pump is open to a grave objection, for which, unfortunately, we are unable to apply any complete remedy of easy application. It will be noticed at once that the motion of the water in its delivery is intermittent, and that only as the piston ascends does the flow into the tank commence, that action ceasing as soon as the bucket descends. This means a great loss of power, since the flow being retarded each stroke of the piston entails the dead weight of the water being again and again overcome afresh.

In old-fashioned force-pumps it has been calculated that nearly 80 per cent. of the power exerted is lost, from this and other causes. In making a model, therefore, where the maximum use of the available power is a paramount necessity, we must give most careful attention to everything which may reduce friction and dead weights to the lowest degree possible. Hence, a few details in the manufacture of our pump should be carefully noted. First, let us arrange that the arm, *L*, shall be of the same, or nearly the same, internal dimensions as the pump cylinder; also, that the valve at *o* shall be the fullest size which the pipe, *L*, will allow. Moreover, instead of adopting the old-fashioned hinge valve at *o*, it will be better to use a cone without attachment of any sort, see Fig. 2. By these simple arrangements we shall avoid one of the chief sources of friction which always arises when water from a large bore is forced suddenly through one of much smaller dimensions, especially when the old-fashioned hinge valve entirely impedes the flow on one side of the pipe. Besides this, let us make another radical change in the lower arrangements of the pump. It is usual to find the ingress pipe, leading from the well to the pump cylinder, of small size; by this method we again lose much power, owing to the small surface of the water presented to the bottom face of the bucket.

There is no reason why we may not as profitably increase the size of the suction pipe

as we did the delivery pipe, since the friction caused by drawing the water through a small pipe into a large one is almost as great as that caused by forcing it from a large channel into a smaller one.

Experience has also shown that it is a mistake to have the nozzle ends of the suction and delivery pipes uniform with the rest of the pipe; the form of the nozzle having a considerable effect both on the discharge and suction. In making our nozzle the very simple expedient of expanding the extremities of those pipes into a cone form, see Fig. 2, will have the effect, under like circumstances, of allowing water to enter and leave the suction and discharge pipes by the difference between 5 and 3, that is, while a volume of water represented by 3, could enter a straight nozzle, or be discharged therefrom in a given time, 5 similar parts would enter through or be discharged from the conical form.

We cannot hope to recover anything like the 80 per cent. of power referred to already, which arises through friction, bad fittings, and mistaken principles, but we may be sure that a careful adoption of the suggestions now being made will result in greater readiness on the part of our model to work, than we could have expected without them, for all friction saved clearly means so much less work to be required from the sails. We must now, having constructed our pump, proceed to fix it upon a solid base, and respecting which it is unnecessary to say much since circumstances must guide us as they arise, solidity and firmness are, however, of the chief importance, machinery on the wobble being always unsatisfactory and uncertain in its action. Upon the base we must next proceed to erect the framework which is to carry the connections intermediate between the pump and the sails. Fig. 3 will, in the main part, explain itself. In it we see *A*, an axle fitted with a crank; *B*, a toothed wheel, *V*, with the teeth cut on the half face, working into a similar wheel on the axle, *E*, connected with the sails. The axle, *A*, works in bearings, *C*; *D* is a forked connecting rod, working between the piston rod, *E*, and the crank, *B*. The distance between *d* and *d* in the crank is equal to the stroke of the piston rod in the cylinder;



m, m are upright bearings, into which n, the head of the piston, is fitted, and between which the head, n, runs; s is a flywheel of moderate weight. We now come to the motive portion of the entire model, and the part over which, we presume, "Dead-beat" came to grief.

mill, sails and all, into the wind as it changed, but, as our machinery must attend to its own wants, we are debarred from such a method of treating the difficulty. Fig. 4 will show how to overcome the problem. It will be seen, on investigation, that instead of fixing the sails

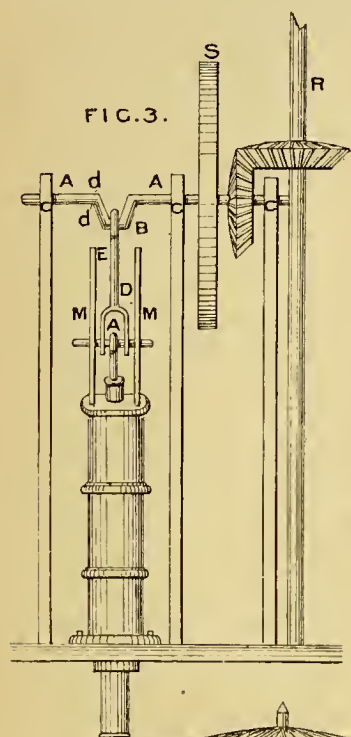


FIG. 3.

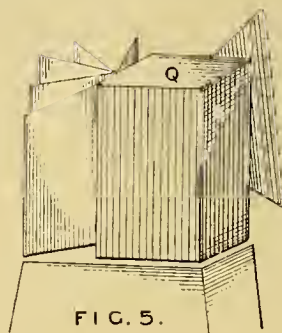


FIG. 5.

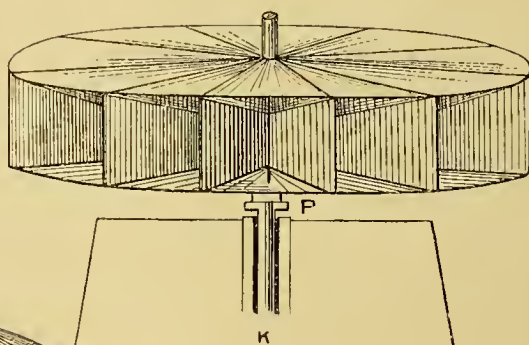


FIG. 4.

FIG. 2.—SECTION OF FORCE PUMP. FIG. 3.—CONNECTION OF PUMP WITH SAILS. FIG. 4.—POSITION OF SAILS ON MILL. FIG. 5.—ROTATORY HEAD PROVIDING FOR CHANGE IN DIRECTION OF WIND. FIG. 5B.—ALTERNATIVE FORM OF HEAD.

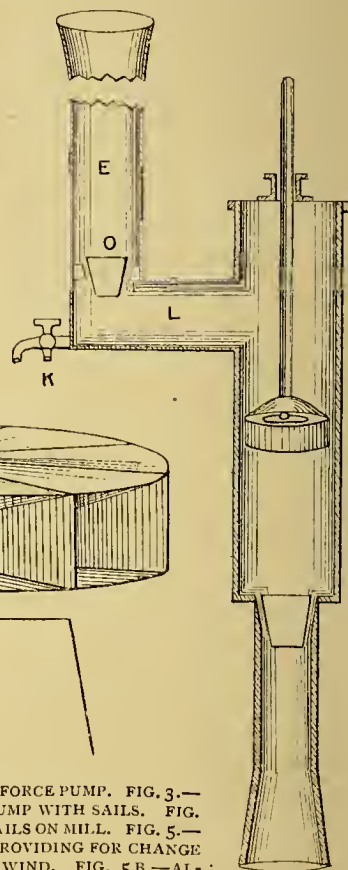


FIG. 2.

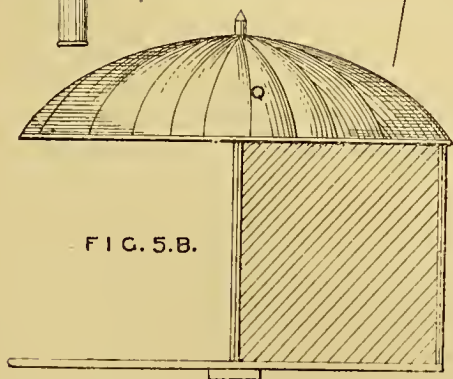


FIG. 5B.

The point with which we have to contend is the difficulty of keeping our machinery and the sails above continually in gear, however often the wind may change. Could we live in our mill, we should, of course, avail ourselves of the ordinary methods of turning the head of the

on the side of the mill, we lay the entire framework flat upon the mill-head, which, for this special purpose, is made large and wide. Of course, this framework does not rest full upon the mill-head, but is lifted slightly above it, being supported by a properly formed shoulder, p, on the upright, k.

Having erected our sails, our next step is to provide that a certain portion of them only shall always be in the line of the wind, for if we were to leave the entire set of sails as they appear

when raised to the mill-head, they would dash wildly round, sometimes in one direction and sometimes in another, and very quickly racket the pump to pieces.

Now, if we can by any means provide that the wind shall always be directed to a portion only of the sails, so that the direction of the sails shall be constant under any and all conditions and variations of the wind, our difficulties are surmounted, and our mill will never be out of gear.

Fig. 5 shows the scheme. The simplest way to explain it will, perhaps, be to say that we must merely put on and over the sails a rotatory head from which we have cut away one side, or one half. The half-head which is left must be provided with a large and wide fan or tail, for the purpose of keeping the half-head in its original position relatively to the sails, whatever be the wind's direction. In fact, it is not unlike a certain form of chimney-pot cowl which may sometimes be seen spinning round. Let us take Fig. 6, and see what happens on a change of wind.

Fig. 6 shows, in outline, the sails and half-open cover or cowl with its fan tail.

The wind, let us suppose, is blowing from the south, consequently the tail turns at once

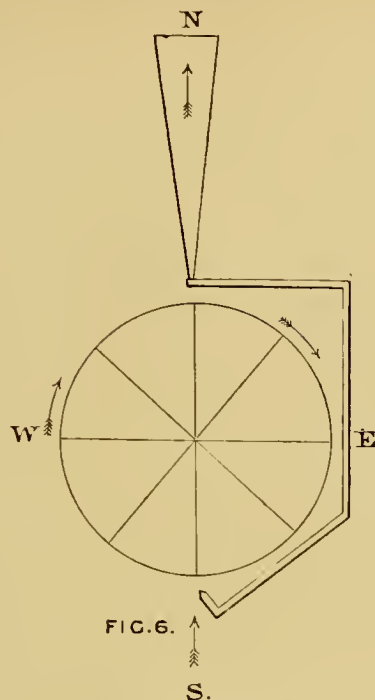


FIG. 6.  
PLAN SHOWING POSITION OF SAILS AND COWL WITH THE WIND BLOWING FROM THE SOUTH.

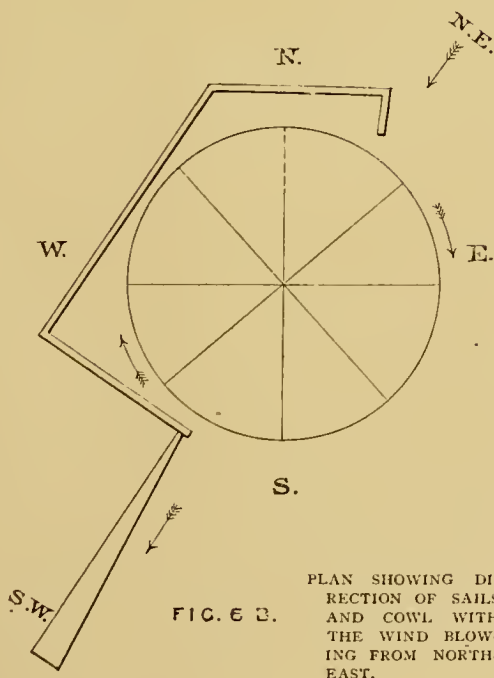


FIG. 6 B.  
PLAN SHOWING DIRECTION OF SAILS AND COWL WITH THE WIND BLOWING FROM NORTH-EAST.

to the north, presenting by this movement the closed side of the head to the east, and its front to the south. The wind blowing from the south now strikes that portion of the sails only which is open and exposed, and, consequently, carries round the sails in the same northerly direction, that is, the east side being closed, from left to right. Half an hour after the wind changes, and goes from S. to N.E., upon this the fan immediately, and, indeed, during the change, passes round and points in the opposite direction, Fig. 6 B, that is, to the S.W., carrying the half-head with it, leaving, as before, one half only of the sails open to the N.E., and in line with the direction of the wind. A moment's consideration of

the diagram, Fig. 6 B, will show that it does not matter how often the wind changes, or what the new direction may be, since the tail must always, so long, that is, as the head is kept in easy going order, follow the line of the wind, and thus, also, always keep half the sails covered, with, consequently, an unvarying direction of movement on their part, the wind acting as a constant force in one direction upon the portion of the sails exposed.

The simplest mode

of constructing this half-head will be found in making the bottom and sides together, the long beam upon which the fall is constructed running through and fitting over the axle,  $\kappa$ , at  $p$ , a shoulder. If, however, we have means at hand we may, if we prefer, make the head of sheet tin or zine, cowl-shaped, as in Fig. 5 B. In putting the model together the eap would be placed first upon the axle,  $\kappa$ , then the sail frame would be dropped inside to rest upon the square shoulder,  $\kappa$ , and finally the cover or top,  $q$ , of the half-head screwed down over all.

The half-head, if of wood, is made wedge-shaped, Fig. 6, on the side opposite the fan, for the double purpose of presenting less surface to the wind, and, also, of turning such wind as strikes the end direct upon the sails. It is, of course, of very great importance that the head should hang or rest as lightly as possible upon the axle,  $\kappa$ , since, if there is any friction above what is inevitable, the sails will not be in the line of the wind when small variations take place.

The length of the arms of the sails should be as great as possible, thereby increasing the leverage upon the axle to the greatest extent possible; the width of the sails, also, should be greatest at the extremity furthest from the centre. It need hardly, perhaps, be pointed out, that this method of working a mill would scarcely be practicable in any form but a model, or on a small scale.

It would be almost impossible to construct a building of any height that would withstand the strain of such an out-of-proportioned head.

In a model, however, all the parts and fittings can be made of much greater strength, proportionally, than can be arranged on a large scale. The skeleton building must now be enclosed, and, if due care has been taken in fitting up the various connections, we think that "Dead-beat" may yet raise the water he requires, and thus have a chance of assuming, after all, a somewhat more encouraging motto.

It is quite possible to utilize wind power as a motor for the amateur's workshop, and I intend, at a future date, to give a paper on the subject.

## TELESCOPE STANDS.

By OLIVER BECKERLEGGE.

I.—APPARENT REVOLUTION OF THE HEAVENLY BODIES—  
INCLINATION OF THE EARTH'S AXIS—ALTAZIMUTH  
STAND—PEDESTAL FOR STAND—FRAMING AND  
FIXING.



IN describing the telescope which has appeared in AMATEUR WORK, I kept before me the need of simplicity combined with efficiency, and to realize these two qualities was compelled to depart from the regulation type. But this of itself is no drawback. The mere outward form of an instrument is as often the result of convenience on the part of the manufacturer as anything else. Machinery is adapted for a particular pattern and hence that pattern becomes fixed. It is no uncommon thing for the amateur who is not hampered by these things, to devise an improved pattern, which eventually finds its way into the market. In making these remarks, I have neither hope or expectation that such will be the case with the arrangement I have designed, but simply to show that a thing may be good, although it departs widely from the orthodox type.

In designing a suitable stand for the instrument, I shall keep the same point before me—simplicity with efficiency; and shall work upon lines either new or old, as it may best suit my convenience.

Before the young astronomer can commence working, he must have an intelligent conception of what he wants to accomplish and how to do so.

We will suppose ourselves to be standing in the open air, on a clear starlit night. Facing the north we see the familiar constellation known as the Great Bear. As we watch it hour by hour, we find it moves forward from east to west in a circle the whole of which circle is completed in twenty-four hours. If we carry the eye upward from the two innermost stars or *pointers*, we shall reach a star which seems never to move, but around which all other stars revolve; this is known as the *Pole Star*. As a matter of fact, it is known to most that this star is not actually in the centre of the circles made by the stars, but is so



near that without instruments its displacement is not discoverable. Letting the eye travel further from the centre we find that the stars make larger circles but all in equal time, that is to say, they make a complete circle in twenty-four hours. At last we come to stars with a circle so wide that at their lowest point they just touch the northern horizon, causing the eye to travel from the north, eastward stars will be seen to emerge from beneath the horizon making large circles, descending the western sky, and disappearing for a few hours only. Coming to a point due east to the point of observation, stars will arise and remain in the visible sky for twelve hours, sink into the west, and remain beneath the horizon twelve hours. Passing from east to south, the section of the circle in which they are visible becomes smaller and still smaller, until at last they just appear above the horizon for a brief time to disappear for the remaining portion of the twenty-four hours. Now it will be understood by the veriest tyro in astronomy, that these star motions are only apparent and not real. As a matter of fact, for our present purpose these stars may be said to be at perfect rest, but as our earth turns every twenty-four hours on its axis from west to east every part of the heavens is brought into view; and, as further, the earth moves so smoothly that no sense of motion is given to us, the *optical* effect is that we are at rest and the objects around us are revolving.

A phenomenon rudely illustrating this will have been noticed by most persons when riding in an express train at right angles to ploughed furrows on land; the optical effect being as though the furrowed land was spun on a centre whilst we remained stationary.

It will be manifest that any star in direct line with the axis of the earth's rotation will appear immovable, whilst all stars receding from that part will appear to perform circles.

Fig. 1 will help to make this clear, S., N., Z., Nr. comprise both hemispheres. At E the Earth is revolving round the Sun on the plane S., N. Now, as it is well known, the Earth does not revolve on its axis perpendicular to the plane of its revolution round the sun. For any

mechanical or mathematical law it might have so revolved, but had it done so, there would have been no variation in the length of days or difference in the seasons. The axis inclines at an angle of  $23\frac{1}{2}^{\circ}$  from the perpendicular Z., Nr.; consequently a star at p in a line with the Earth's axis will never suffer apparent displacement relative to the position of other stars from whatever part of the Earth's surface it may be viewed, inasmuch as the immense distance it is placed from the observer, as compared with even the diameter of the Earth, is so great that the angle at which it is viewed is so small as to render all rays of light practically parallel. Fig. 1 represents a section of the heavens looking east. A star at a will perform a circle around p, the diameter being a'; b b' and c c' being larger circles, the stars remaining continually above the horizon. A star at d sinks below the horizon at d'. At e it arises due east, and remains in the sky overhead for twelve hours. At f the star is but a little elevated in the southern sky, and remains visible but a short time, disappearing at f'; whilst a star at g never rises high enough to be visible in the northern sky.

I have stated these elementary facts, as they lie at the foundation of the whole subject of telescope stands, and to these facts we shall have to refer again as we proceed.

There are two kinds of stands in general use, the Altazimuth and the Equatorial. There is, also, a simple arrangement for converting the first into an Equatorial. We shall for convenience take them in this order.

The Altazimuth, as its name indicates, is an arrangement by which a telescope can be moved in alt or towards the zenith and also in a line at any angle to the same, right and left.

By these two movements a star can be followed through any part of its circle. For a small telescope with a low power this stand will meet the requirements of many amateurs. But where stars are viewed with high powers it is necessary to have another arrangement, inasmuch as the tremor and motion is magnified as well as the object.

In addition to this fact, they pass correspondingly quickly out of the field of view,



We must next prepare a cradle to receive the telescope. This may be made of wood or metal. Wood will answer, I think, all practical purposes, though, perhaps, some may prefer metal. At the ends of the pedestal there will be a flange with bolt holes. We will assume that the flange will be 10 inches in diameter. Procure two pieces of mahogany or other hard wood,  $1\frac{1}{2}$  inches thick, and turn two discs, 12 inches diameter. In the centre of each a hole must be turned, say, exactly 2 inches diameter. These must be joined by two blocks, 4 inches wide and 2 inches thick. Fig. 2 will make this clear. Care must be taken that the holes are perfectly coincident with each other. Procure a third disc, the same size and thickness as the other two, and with a central hole.

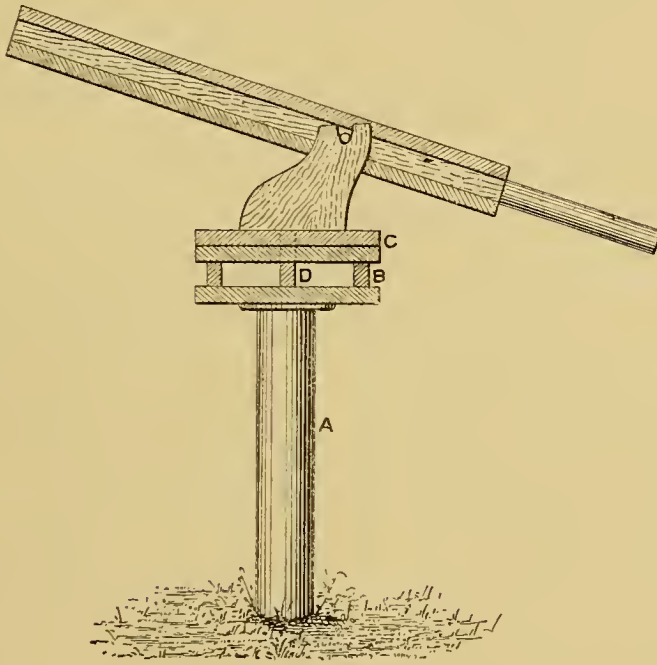


FIG. 4.—THE TELESCOPE, MOUNTED.—A, Pedestal; B, Block bolted to the Pedestal; C, The Trunnion carrying Telescope; D, Central Pin fastened to C and Bearing on the Stand, B.

Two cheeks must now be cut out of  $1\frac{1}{2}$  inch mahogany, as Fig. 3, with tenons to mortise in the disc just made. Measure the diameter of the telescope tube and plates carrying the trunnions, which, we will assume, will be 5 inches. Draw a central line through the disc,  $2\frac{2}{3}$  from the centre draw lines for indicating position of cheeks. Lay the cheeks together and see that they are exactly the same size; also that the tenons are true with each other. At the point indicated, a, Fig. 3, drill a hole through each to take the trunnions; these must be made

after careful measurement, as when the cheeks are fixed in their place, a rod passing through the holes should be at perfect right angles with the cheeks, as, if not, the motion of the telescope can never be true and smooth. Now take 14 inches of 2 inch brass tubing, chuck it in a lathe, and run the tool over it to make it perfectly true.

Cut the ends true, and solder a disc of stout brass to one end. This must be turned true and square with the spindle. Three or four holes must be drilled in the disc for screws. This spindle must now be passed into the disc, as shown, fitting it tightly. Care must be taken that it is perpendicular to the disc. It must be secured in its position by screws. This spindle must fit the central holes in the block we have already made. Although, for convenience of description, I have left the spindle till last, it had better be

made first, and the holes in the block turned to fit it. If so desired, these holes can be turned large enough to take bushes, but, as the friction will be but very little, there is no real necessity. Cut a piece out of the tops of the cheeks down to the holes to receive the trunnions. By this means the tube can be lifted off its stand, which will be a convenience. These bearings can be bushed if desired, but, as in the other case, the friction is so little that



there is but small need that it should be so. We have assumed that there are holes in the flange of the pedestal. Corresponding holes must be made in the lower disc of the block to receive a couple of screw bolts. When this is done, we shall have a very rigid stand, allowing us to turn our instrument in two directions perpendicular to each other, and, by combining these, it will be apparent that we can move it at any angle so as to follow a star in its movements. There is, however, this drawback: from the form of the stand it will be impossible to raise it to the zenith. This, however, is not of so much importance, as, by selecting our time, we may turn the instrument on any given star when it has passed to the opposite diameter of its circle.

It may be that some amateurs may prefer a stand in metal. This being so, the wood stand now made may be taken to a founder, and a metal one cast, which will have to be turned and fitted. But, as it will be of considerable weight, there are but few amateurs who would have appliances for the work, so it would have to be fitted as well as cast. This, however, should be remembered, that if a metal stand is intended from the first, the wood mould need not be nearly so heavy. As far as this form of stand is concerned, our work is done, and in the next chapter we shall proceed with more ambitious work, namely, the Equatorial.

## SAFETY BICYCLE CONSTRUCTION FOR AMATEUR MECHANICS.

By A STEVENSON.

### VII.—DETAILS OF FRAME.

**W**E have now to consider some of the details of our Safety Bicycle frame. It will be observed by the intelligent reader, that the function of the backbone, in conjunction with the back forks, is that of a beam or girder that has got to carry a load. Treated as a load-carrying beam, it is supported at the points, a and e, Fig. 36, and the load is carried at the point, b, which is near the centre of the length. Now, as the frame is constructed

of thin, light material, and the load to be carried is, perhaps, 160 pounds, this beam has got to be strengthened, and as the usual method, in building construction, of strengthening a beam is by tie rods, so we strengthen our backbone in the same manner. We apply the tie rod, e, to the foreward part, and the two tie rods, f, f, on either side of the rearward part, the descending tube, d, acting as a stay or strut.

It will be at once apparent that these ties greatly stiffen or strengthen the backbone, which cannot possibly sag or bend downwards at the point, b (which is the weakest point in the whole construction), so long as the ties and their fastenings hold good.

The fore tie, e, is bent and flattened at the ends, as shown, Fig. 38, a, b, and being made of  $\frac{3}{8}$  inch round steel the ends have to be staved up in the forging, in order to have metal of sufficient strength when bored, for  $\frac{3}{8}$  inch bolts, as the flattened ends should be  $\frac{1}{4}$  inch thick, and have at least  $\frac{1}{4}$  inch of metal round the holes. The foreward end of this rod is bolted to the underside of the backbone tube immediately behind the neck, and where the neck-piece is fitted and the tube solid, a hole should be drilled about  $\frac{3}{4}$  inch deep and fully  $\frac{5}{16}$  inch in diameter, then plug-tapped to  $\frac{3}{8}$  inch for a short bolt, screwed to near the neck. The other end is bolted in the same manner, in the centre of the underside of the chain-wheel bracket, as shown, Fig. 37, which is a view of the underside of the frame. The two rear ties are made the same as to their ends (except they are not bent) as that described, and are bolted, as shown, Fig. 37, one end to the *inside* of the vertical parts of the chain-wheel bracket, and the other to the *outside* of the solid parts in the rear ends of the hollow forks, at c. I put these on with  $\frac{5}{16}$  inch counter-sunk-headed screws, as they are better out of the way than projecting heads, which are apt to interfere with the chain or the step.

Fig. 37 also shows the driving-hub in its place, as well as the chain-wheel in position in the bracket. In adjusting the chain-wheel on its shaft care must be taken to place it exactly in line with the cog-wheel on the hub, otherwise the chain will not run sweetly, if, indeed, it stays

on at all. Usually the crank shaft which carries the chain-wheel is from 7 inches to  $7\frac{1}{2}$  inches long and  $\frac{3}{4}$  inch thick. The cranks each take up about  $\frac{7}{8}$  inch, then the sleeves of the bearings, if ball bearings are used, come up close to the cranks, then close up to one of these sleeves is placed the chain-wheel, which must be well keyed

on very tightly they are, by reason of their hardness, apt to break. Then the cranks should have their eyes not over  $\frac{5}{8}$  inch, so that a little shoulder is left on the shaft just outside the sleeves, for the cranks to stop against.

A most vital point in the construction of this part of the machine is to have the cranks

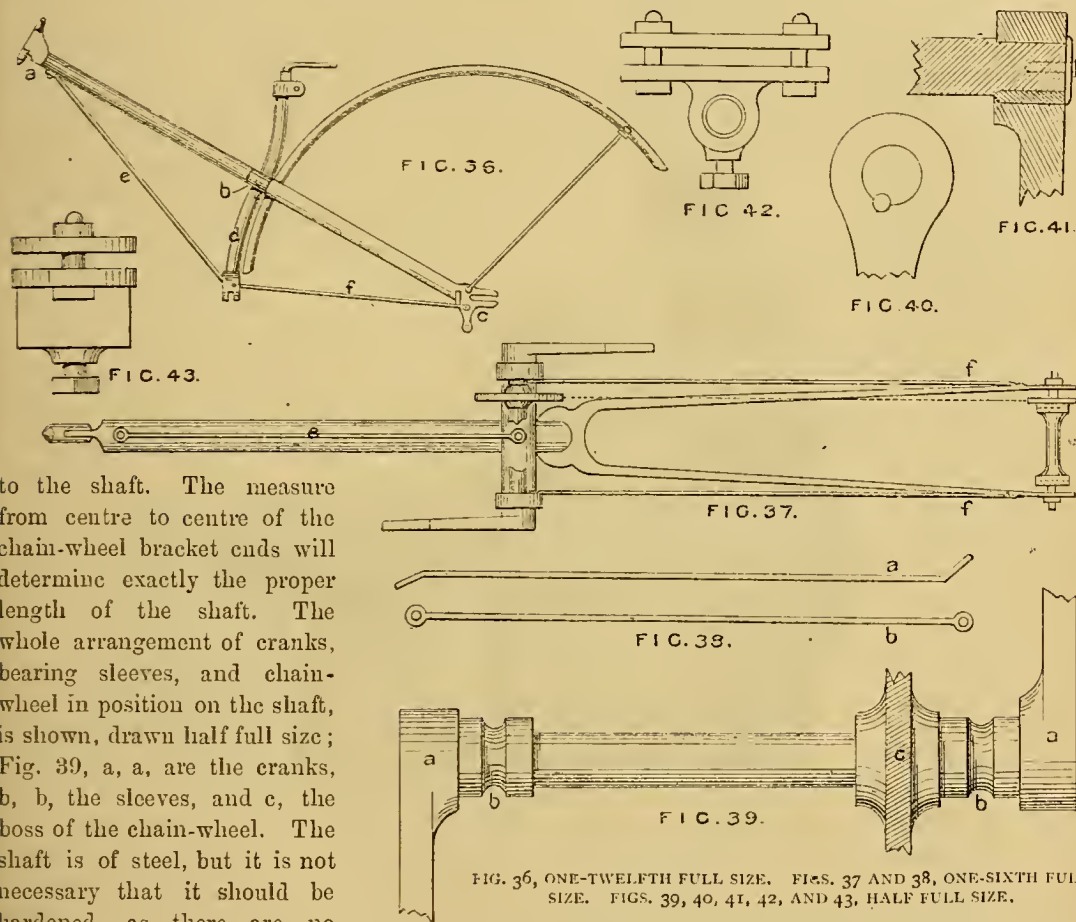


FIG. 36, ONE-TWELFTH FULL SIZE. FIGS. 37 AND 38, ONE-SIXTH FULL SIZE. FIGS. 39, 40, 41, 42, AND 43, HALF FULL SIZE.

to the shaft. The measure from centre to centre of the chain-wheel bracket ends will determine exactly the proper length of the shaft. The whole arrangement of cranks, bearing sleeves, and chain-wheel in position on the shaft, is shown, drawn half full size; Fig. 39, a, a, are the cranks, b, b, the sleeves, and c, the boss of the chain-wheel. The shaft is of steel, but it is not necessary that it should be hardened, as there are no frictional or running parts, in consequence of the sleeves being fitted to it; these sleeves which carry the steel balls in the hollows shown are made very hard, and are fixed to the shaft with a small screw-pin in each. In turning the shaft, first of all the chain-wheel is fitted on, the eye of which should be about  $\frac{3}{4}$  inch; next the two sleeves, their eyes, perhaps, a little less; these should be fitted to go on tightly, but with very light driving, as if they are driven

and chain-wheel fitted in such a way that they will be perfectly rigid on the shaft and not work loose in a short time. The key for the chain-wheel should be not less than  $\frac{1}{8}$  inch broad and fully  $\frac{1}{8}$  inch thick; it should be of a length to pass right through the boss of the wheel. If this is well-fitted there is little danger of the wheel getting loose. As to the cranks, there are various methods of fitting them, some of them very stupid expedients, such as that of

fixing on the cranks hard and fast with keys driven from the outside along the shaft. A favourite method is to bore a hole right through the crank when fitted on the shaft, in such a way that the drill will cut away a part of the shaft, perhaps, half the diameter of the hole. This hole is made taper with a reamer, and a taper pin fitted. The pin is screwed for a nut on the small end, and the head, or thick end of the pin, projecting considerably, allows for any looseness of the crank on the shaft being taken up by driving in the pin and tightening up the nut. My objection to this method is, that the large hole weakens the crank at a vital part. My favourite method is shown, Figs. 40 and 41, half size. I fit the crank tightly to the shaft, then file the end of the shaft and crank quite level; then bore a  $\frac{1}{4}$  inch hole, half in the shaft and half in the crank, parallel with the axis of the shaft, and of the full thickness of the crank, see Fig. 41; into this hole I fit a steel pin driven fairly tight, then filed flush with the end of the shaft. Next, in the centre of the shaft, I bore a  $\frac{3}{16}$  inch hole, say,  $\frac{1}{2}$  inch deep, and screw it for a pin with a slot head, a washer, a little more in diameter than the shaft, is fixed on with this pin, as shown, Fig. 41. This prevents the key-pin working out, the cranks never get loose, and they may be readily taken off by removing the washer and tapping them off with a hammer, using a bit of wood under it.

In Fig. 36 is shown the L pin for the saddle. This pin is a solid steel forging. It should fit the tube exactly, so that it will clamp tightly with the split collar. If the top part of the tube is quite vertical, then the L pin will be bent to a right

angle. If it inclines somewhat backwarks, then the pin must be correspondingly less than a right angle, so that it may be level where the saddle bracket goes on. This bracket is shown, Figs. 42 and 43, and is made to clamp the spring under the saddle. The under part of the spring passes between the two plates, and is clamped firmly down with the two bolts. That part of the L pin that carries this bracket is  $\frac{5}{8}$  inch thick, and, being some 5 inches long, allows for some adjustment laterally, while a vertical adjustment is obtained by the movement of the L pin in the tube, into which it descends some 4 inches.

FIG. 1.—DOVETAILING MACHINE IN USE.



Fig. 36 also shows the mud guard in place. This mud guard is about one-third the circumference of the wheel. It is fixed in its place at three points, namely, at the chain-wheel bracket, the fork, and by two stays. Its lower end is attached to the solid part of the tube, about  $\frac{1}{2}$  inch above the chain-wheel bracket, by a small screw stud;

a similar stud fixes it in the *oxter* of the fork at b. The word *oxter* is a Scotticism, very expressive of the part meant, and, as a single word, has no equivalent in English. Its outer end is supported by two stays of  $\frac{1}{4}$  inch round wire, in the same manner as described for the front wheel, except that its lower ends are not attached to the ends of the axle pin, as in the former, but fixed to the solid part of the fork ends by small screw studs, as shown at c, Fig. 36, leaving a clear space to fit an attachment for adjusting the rear driving-wheel, and particularly the tension of the chain, and as this adjustment is a most important matter, we will leave it to be fully described in next paper. (To be continued.)



# NOTES ON NOVELTIES.

By THE EDITOR.

6. **BRITANNIA COMPANY'S PATENT DOVE-TAILING MACHINE.**—Some months since, I intimated to the readers of *AMATEUR WORK* that such a machine was in course of preparation, and I am now in a position to give illustrations and description. The appliance is quite simple and easy to use, and, as it enables an amateur to cut a perfect dovetail or any number of dovetails with quickness and precision, there is little doubt that all amateur mechanics who possess a circular saw will add this useful appliance to their list of tools. Fig. 1 represents the appliance in use, Fig. 2 shows a front view of it, Fig. 3 represents the two parts of it side by side. The two parts of the joint are cut on the two frames in Fig. 3; the mortises being cut on the inclined frame and tenons on the horizontal frame. Both frames are mounted on a board, which slides backwards and forwards on the table of the saw, parallel with the plane of the saw, which passes through a slot in the board. If the workman is cutting the mortises he clamps the inclined frame to the board at right angles to the saw. He then places the timber upon the frame holding a gauge (Fig. 1) against one side of it, the end of the gauge taking into a mark of a scale on the frame. He then pushes the board forward, carrying the timber over the saw and cutting a gate through it. He then returns the

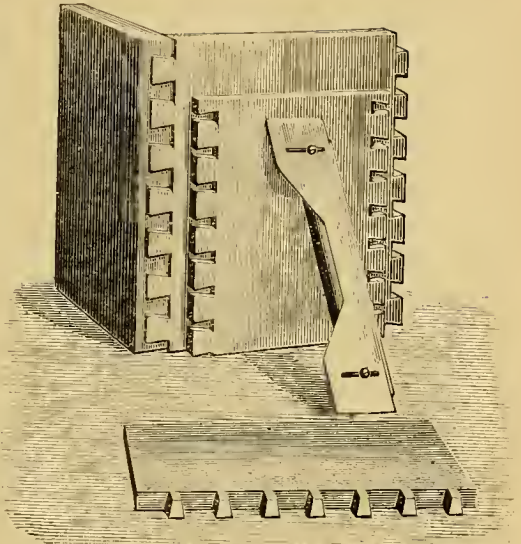


FIG. 4.—DOVETAILS CUT WITH THE MACHINE.

board and adjusts the timber to the next mark of the scale, when he cuts another gate, and so on to the end. He then reverses the timber and cuts the other set of gates, after which the remainder of the work must be done by a chisel. The tenons are cut on the other frame. This is horizontal and is placed at an angle to the plane of the saw. A full description of the method of using this handy appliance can be obtained by writing to the Britannia Company, Colchester, and it may be seen at their Show Rooms, 100, Houndsditch, London.

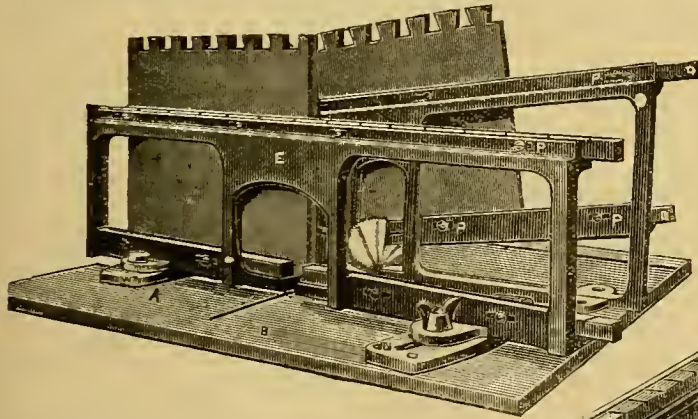


FIG. 3.—BACK VIEW OF FIG. 2.

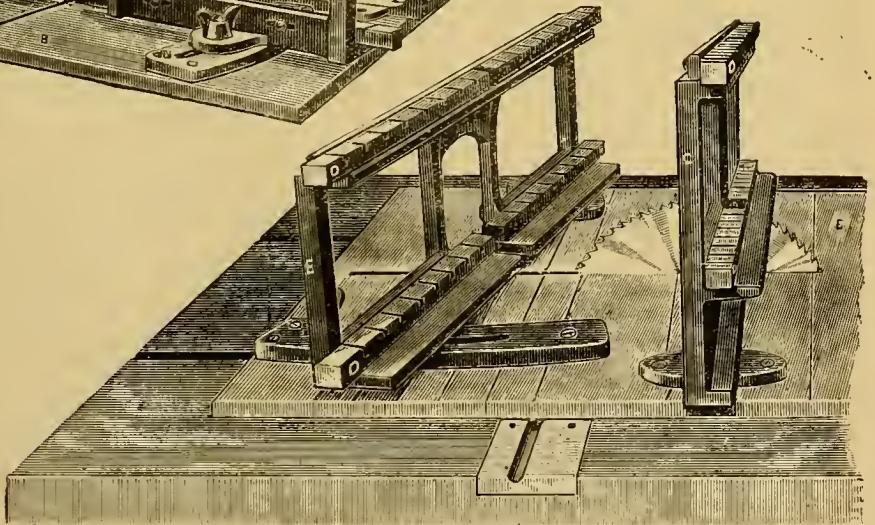


FIG. 2.—FRONT VIEW OF THE DOVETAILING MACHINE FIXED ON THE CIRCULAR SAW TABLE.

## AMATEURS IN COUNCIL.

For "Instructions to Contributors and Correspondents," see page 46 of this Volume, or Part 13 (New Series), p. 46.

## Safety Bicycle.

CYCLIST.—You will find, I think, that the prices of most of the parts, as well as where to purchase them, are not forgotten towards the end of the series. Perhaps it would have been better to have mentioned them in an earlier chapter. It may be of benefit to CYCLIST and others to give these particulars now, in the form of a reply to query. As to the parties who supply them. I may mention: Wm. Bown, 308, Summer Lane, Birmingham; W. A. Lloyd, Weaman Street, Birmingham; Thomas Smith, Saltly Mills, Birmingham; Henry Matthews, Snow Hill, Birmingham; Brown Bros., 7, Great Eastern Street, London; J. Devey, Berwick-on-Tweed; J. Harrison, Kensington Works, Birmingham; Sanson, Teale and Co., Premier Works, Salop Street, Birmingham; Thomas Warwick and Sons, Abna Street, Birmingham; J. Lucas and Sons (for bells, lamps, etc.), Little King Street, Birmingham; Brown and Evans (for nickel-plating and enamelling), Bowling Green Lane, Farringdon Road, London, E.C.; Wilkins and Co., 66, Holborn Viaduct, E.C. I have not dealt with all of the above, but have been well served by Bown, Lloyd, Harrison and Devey.

|                                                                                 | PRICES.         | s. | d. |
|---------------------------------------------------------------------------------|-----------------|----|----|
| Bown's Safety hack buh (hall)                                                   | 16              | 0  |    |
| Bown's front hub (ball)                                                         | 12              | 6  |    |
| Safety bottom bracket complete, with chain wheel and cranks (hall)              | 27              | 0  |    |
| Bown's pedals, plain, 7s. 6d.; ball                                             | 14              | 0  |    |
| Lloyd's tubes, per ft., 1½ in., 1s. 5d.; 1½ in., 1s. 3d.; 1 in., 1s. 2d.; ¾ in. | 1               | 1  |    |
| Handle bars, hollow                                                             | 2               | 6  |    |
| Horn handles, per pair                                                          | 2               | 0  |    |
| Sets of brake work, in the rough                                                | 2               | 6  |    |
| Semi-hollow front forks, carved                                                 | 3               | 6  |    |
| Hollow hack forks, pair                                                         | 2               | 4  |    |
| Fork ends, 8d., centre bracket stamping                                         | 1               | 0  |    |
| Steering lugs and pin, finished                                                 | 1               | 9  |    |
| Lloyd's bottom bracket, with chain wheel and cranks (ball)                      | 17              | 6  |    |
| Abingdon Humber chain, 1 inch pitch                                             | 1               | 8  |    |
| Common chain                                                                    | 0               | 10 |    |
| Chain wheels, bored and punched                                                 | 2               | 4  |    |
| Pairs of cranks, rough                                                          | 1               | 0  |    |
| Ditto, finished and plated                                                      | 4               | 0  |    |
| Springs                                                                         | from 1s. 6d. to | 8  | 6  |

Saddles ... from 2s. 6d. to 10 0  
Lamps ... from 3s. 6d. to 12 6  
Pair Safety rims, crescent ... 3 0  
Hollow rims, crescent ... 15 0

W. A. Lloyd is at present selling pairs of Safety wheels, with Bown's bearings, for 30s. a pair, very cheap. Rubbers for tires, from 2s. 6d. to 7s. 6d. per pound; a pair of fairly good rubbers for 30 in. Safety cost 10s. The above comprehend most of the materials that go to make up a Safety, but CYCLIST will get fuller information by writing to some of the before-named firms for their price lists. As

they are adjusted at the rim by nipples, and a hollow rim is a necessity, as the nipple finds a bearing on the inner surface of the rim, and is worked with a small key, which passes through a hole in the outer or rubber-bearing surface. Annexed is a sketch of part of a laced wheel, commonly called a "Tangent," which it is not. It will be seen that the spokes cross each other twice. The spokes numbered 1, 2, 3, 1, 2, 3, etc. are of the same wire. Fig. 2 is a diagram of a nipple, full size. The part, A, passes through the rim, while the part, B, is made 6-sided, like a nut,

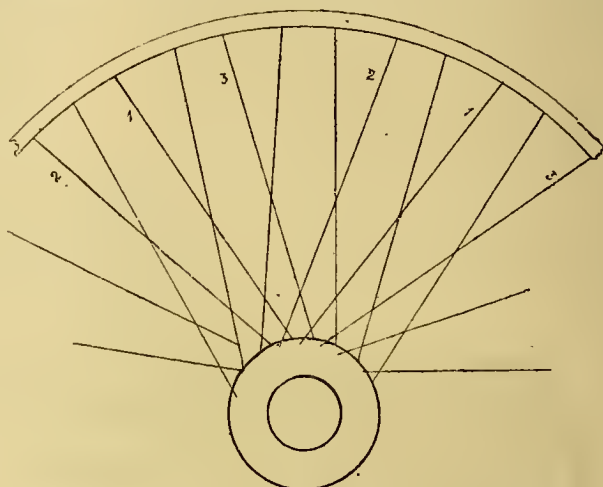


FIG. 1.—CONSTRUCTION OF A "TANGENT" OR LACED WHEEL.

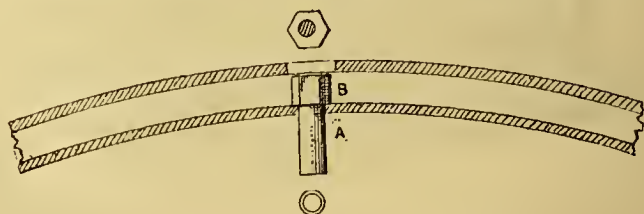


FIG. 2.—DIAGRAM OF A NIPPLE, FULL SIZE.

to the building of Tangent wheels. I don't know that there is a true Tangent wheel in the market. Many of the wheels called "Tangent" are not so, they might more properly be called "Sector" wheels. The nearest approach to a Tangent wheel is that made by the makers of the "Rapid" Safety. There are two methods of building the "Tangent" wheel so-called, one method is to have the spokes with heads at the hubs, the other has each wire forming two spokes, being attached to the hub at its middle and going off to the rim, forming two spokes at an angle of about 45 degrees to each other. In both cases

and has a key to fit, with which it is turned. Only the part, B, is screwed inside for spoke. I have never built a "Tangent," or, rather, a laced wheel, though I have repaired a few. Indeed, I am not much in favour of laced wheels, and consider a wheel with direct *batted* spokes and hollow rim, about the best and most durable that has yet been made. The laced spokes are generally tied with bits of wire at their crossings and soldered, and a wheel of this sort is always more difficult to repair than one with the spokes running direct from rim to hub. —A. STEVENSON.



**Instructions for Advertising.**

**AMATEUR.**—The rules and regulations are repeated in Part 13, and you will see that the name and address may be given or withheld at the option of the Advertiser.

 **$\frac{1}{2}$ -Plate Camera.**

**J. T. NISBETT** writes:—"Kindly offer my thanks to **ELECTRON**, through the medium of your Magazine, for dimensions of  $\frac{1}{2}$ -plate camera, which I will endeavour to follow out closely; also to **C. C. V.**, for his trouble in endeavouring to find dimensions. I should be much satisfied with any  $\frac{1}{2}$ -plate camera, so long as it is simple in construction with a square bellows and single extension."

**A Turbine Water Motor.**

**ADAM MENZIES.**—Directions for making a turbine water motor were given in Vol. V. of **AMATEUR WORK** (Old Series), page 164, accompanied with full-sized drawings. The size given is sufficient to drive a lathe, but you can easily enlarge the drawings to any size you may desire. I suppose you are aware that a turbine of the dimensions given in your letter, would, with a head of water of about 90 feet, develop nearly 20 horse-power.

**Small Water Motor for Fret Machine.**

**H. W. D.**—See reply to **ADAM MENZIES**.

**Design for Organ Stool.**

**F. H. IVESON.**—There has been no design in **AMATEUR WORK** for an organ stool, so that it was no wonder you looked through your Parts without finding one. If you continue looking through future Parts, however, you will eventually see what you want. **ORGAN BUILDER** has a paper in hand, which shall appear shortly.

**Cabinetmaker's Bench.**

**L. F. P.**—You can get a good cabinetmaker's bench of **Mr. T. J. Syer**, 45, *Wilson Street, Finsbury Square, E.C.* Write for his price list.

**Liquid Wood Priming.**

**A. W. B. (York).**—Without knowing whether the woodwork of the screen was to be painted or varnished (or polished), I cannot possibly say whether the stuff you saw was priming or not. I am, however, inclined to think it was not, and that, probably, it was a weak stain or even size. Priming would only be used if the screen was to be painted. It is, in fact, the first coat of paint. The use of stain is, of course, obvious. Size is employed on pine in order to prevent absorption of polish or varnish. What a pity you did not ask the joiner what he was using, as then there could have been no doubt about it.—**D. A.**

**Walking Sticks.**

**BELLSHAVO.**—I really cannot undertake to say where you have failed from the information you give; neither can I give any more wrinkles than appeared in my article, which contained all I know on the subject. I only know, that when a boy, I have made many a walking stick on the principles laid down in the paper I wrote, and that I have seen a good many more people follow same methods with success. I have, however, a shrewd guess that you cut your sticks at the wrong time of year; now (December) is a good time to cut. Try again; follow out directions in my article, and also those in another article on the subject, which appeared in Part 12, Old Series, of **AMATEUR WORK**. Post free from Publishers for 7 stamps.—**H. L. B.**

**Organ Building.**

**R. C. H.**—The pieces of organ work already made cannot possibly be used up in any other way except it is to continue the making of the organ. With regard to the action; if the soundboard runs from CC up to the top note in equal semitones, the simplest way to connect the keys with the pulldowns is to make a backfall frame, cutting the grooves in which the backfalls are to work in a slanting direction. None, or hardly any, of these grooves will be played at the same angle. The best way to find the bevel for each is to get a drawing-board the length of the soundboard, mark the pulldowns on a line half an inch from one edge while a line on the opposite edge will represent the holes in the keys into which the sticker pins will go. The distance between these two lines will be obtained by dropping a plumb line from the pulldown in the centre of the soundboard and measuring the distance between that line and the hole in the end of the centre key. Now mark the centre of the keyboard on the one line, then the centres of all the keys on that same line. Mark on the front line the centre of the soundboard, so that it comes quite square with the centre mark of the keys, and from that mark all the pulldowns. Then draw lines from the CC on the one line to the CC on the other, and so on to the top note. Lay the backfall frame, mahogany side downwards, exactly in the middle between the two lines and mark on each edge the place where each of the several lines touches the frame, and then turn the piece over and make a line across to meet the lines on the edges, when you will have the proper

bevel for each groove. If you do this the stickers and pulldowns will then come upright. I cannot say definitely how many stops can be put to the soundboard. What would you like? There may be room for four (certainly not more) sliders, but I cannot say what width each would be, unless you say what would suit you. You could have two 8 ft. and two 4 ft. stops on it. Is the total length of the soundboard from outside cheek to cheek four feet? I must know if you intend to have any pipes in the front. Also, if you would like this, how many, if the pipes are of the Open Diapason or a Dulciana, would be conveyed off the soundboard? I cannot give any dimensions for the bellows, without knowing more of your organ, but you will be on the right side if you have the bellows as large as you can conveniently make them. They should certainly not be smaller than the outside measurement of the soundboard. The material and labour bestowed on a larger bellows is always well laid out. You will find a description of this part of the organ given in Vol. III. (Old Series), page 221.—**ORGAN BUILDER.**

**J. H. (Derby).**—I am much obliged for your good opinion of **AMATEUR WORK**. A professional organ builder is now engaged on a series of papers on the construction of a pipe organ, written with a special view to the requirements of amateurs, and these articles will appear in the next volume. **Hopkins and Rimbault's** book to which you refer, although the standard work on the organ, is not exactly suitable to an amateur, who, of course, requires more detailed instructions than a professional would need. Have you seen the article on Organ Building in Vol. III., **AMATEUR WORK** (Old Series)?

**Lining Cases and Workboxes.**

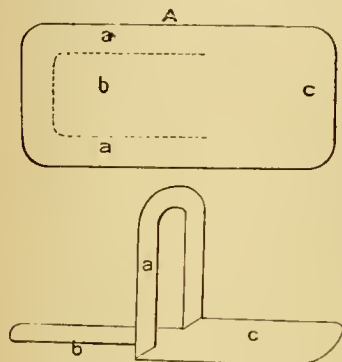
**SUBSCRIBER FROM THE COMMENCEMENT OF AMATEUR WORK** writes:—"Might I suggest, for the instruction of some (probably, a good many) of your readers, the publication of some papers relating to the making, lining, and fitting of such things as gun and pistol cases, workboxes, jewellery cases, etc. I do not remember ever seeing instructions as to this branch of carpentry anywhere. The lining of cases with cloth or velvet is often undertaken—and generally with but indifferent success—by the amateur, and I am under this impression, there are many who would like to know the right way of setting about such jobs." [The subject



you mention is well within the range of AMATEUR WORK, and as, no doubt, others besides yourself will be glad to have instructions, I have arranged with a practical man for a paper describing how this work is usually done by the trade.—ED.]

#### A Bookholder for Bookshelves.

CLERICUS SECUNDUS writes:—"The following simple device, which I saw in use at the Paris Exhibition, may be of use to some of the readers of AMATEUR WORK. It is intended to prevent the volumes on a partially filled shelf from falling about. The diagram will almost suffice to explain it. A is a plate of sheet metal—any metal which the amateur can cut will answer the purpose—length, from 9 in. to 12 in.; width in proportion to the width of the



A BOOKHOLDER FOR BOOKSHELVES.

volumes. The dotted lines show the direction of the saw cut. Then turn A, A up at right angles. To use it the tongue, B, or the part, C, is slipped under the end volumes."

#### Portable Harmonium Building.

F. M. I.—I am sorry to hear that your work, as far as you have got, has not proved altogether successful, but probably the following hints will put you right. You say that the leather tongues in the bellows curl up. This may be remedied by soaking the leather in linseed oil; but should this by any chance be found of no service, a very thin piece of wood must be glued on each tongue. This latter method (although, perhaps, at first sight appearing to warrant more certain success), cannot be recommended in preference to the former, since it is liable to cause a flapping noise. Your next difficulty—namely, that the treadles draw down the tongues covering the holes in each end of the wind-chest—is somewhat vague, for this is really what should happen, as you will understand by the following explanation. Even should I

have failed to grasp your meaning as to the fault you complain of, I feel convinced that when you have overcome the tongue's tendency to curl, you will find that their working will be quite satisfactory; if not, I shall be pleased to bear further from you. Presuming that you are blowing (of course, playing the while or the reservoir will burst), the action of the tongues will be in this manner:—As the treadle springs up, it opens the hellow's tongue, and draws in a fresh supply of air; but immediately a pressure is put upon the treadle, the tongue shuts tightly down and prevents the wind escaping through that vent, therefore causing it to rush up the wind-tube, force open the tongue covering the slot in the end of the wind-chest (which is instantly closed by the suction caused by the re-action of the bellows), thence into the reservoir which it fills out to its limit, and finally to escape through the open reed-slots. The actions of the other treadle and its relative tongues are similar, except that they act in opposition (or alternatively) to those on the other side in order to keep up a constant supply of wind. You will thus perceive, also, that the fact of the tongues not acting properly is the cause of your inability to get sufficient wind into the reservoir. By-the-way, I presume you had the reeds fixed, or the reed-slots stopped up, previous to testing the reservoir, otherwise you could not expect it to fill. Whilst writing on the subject, I had better point out the great importance of having the tongues in the bellows quite clear of the springs within which they work, as the slightest obstacle will hinder their free action and cause irregular delivery. Moreover, be sure to have every necessary part of the instrument perfectly air-tight. On looking through Chapter V. (page 559, Vol. I., New Series), I find I have given the width of the ebony pieces which flank each end of the keys, as  $\frac{1}{2}$  inches, but mentioning that the measurements given must be increased or reduced to suit the requirements of the keys. These pieces I now find should each be from 1 inch to  $\frac{3}{4}$  inch wide, which will enable you to fit your instrument with four octaves of reeds (i.e., twenty-nine white keys and twenty black).—E. A. S.

#### Address.

A. F. SHAKESPEAR.—Messrs. Churchill's address is 21, Cross Street, Finsbury, E.C. I am glad to see your name amongst my correspondents once more, and shall hope to hear from you occasionally when you have settled down.

#### INFORMATION SOUGHT.

##### Weight of Flywheels.

CLERICUS SECUNDUS asks:—"Will some reader versed in the matter kindly inform me what is the relation between the weight of the flywheel and the resultant power? That there is an increase of power with increase of weight I am well aware, but I should like to know something of their ratios, whether, e.g., a flywheel twice the weight of another gives double the power. I should, also, like to know what is the practicable limit obtainable where foot power is the only force comeatable? What is the relation between the increase in the weight of the wheel and the power needed to work it? Lastly, I should be thankful for information as to the weight of the heaviest flywheel which can be readily used where foot is alone available, and what thickness of wood could be cut with a circular saw so mounted."

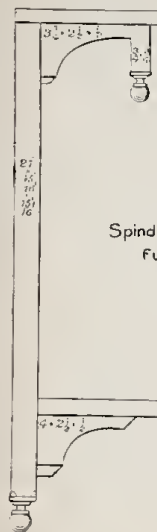
##### Electric Lighting and Gas Explosions.

CLERICUS SECUNDUS writes:—"Mr. Edwinson, in his articles on 'Electric Bells' (Vol. I., p. 449, O. S.), in speaking of the objections of nervous persons to having electric wires connected to their gas pipes, says that their fears (of an explosion) are groundless 'when weak currents only are passed through the wires' (italics mine). Am I to infer from this that Mr. Edwinson holds the danger of a gas explosion in such circumstances to depend upon the strength of the electric current? I happen to have considerable theoretical knowledge of gas and its manufacture, and was under the very decided impression that under no possible circumstances could the gas in the pipes be exploded—not even though the latter were heated to melting point—and that for the sufficient reason that the gas in the pipes lacks, happily, the proportion of atmospheric air needed to transform it into an explosive mixture. As I hope, shortly, under Mr. Edwinson's able guidance, to fix up some bells in my house, and have only gas pipes to which to fix the wires, I should be glad if some expert would decisively settle the point under discussion."

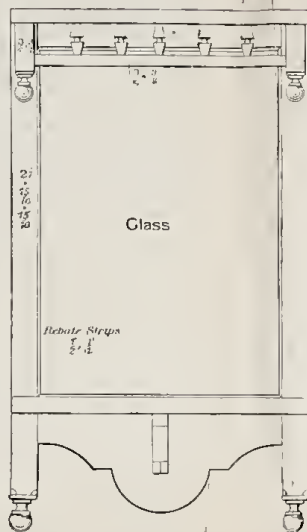
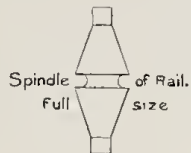
#### LETTERS RECEIVED UP TO DEC. 9.

COTTON COVERED; NIGGER (Croydon); TOM WRIGHT; CLERICUS SECUNDUS; T. M.; MR. SANDERSON; S. M. L.; PARRY DE WINTON; A. YOUNG; ATHOS; A FOUR Y.ARS' SUBSCRIBER.

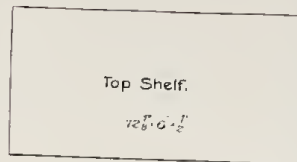
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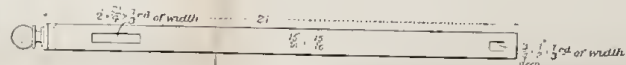
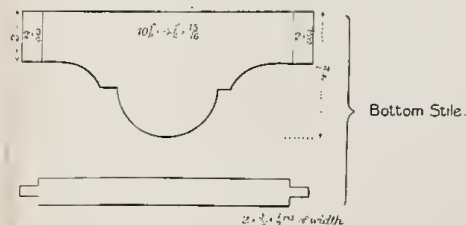
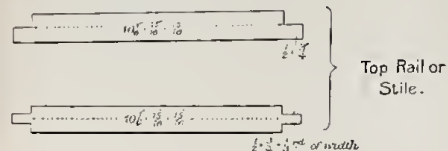
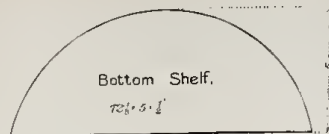
End



Front.



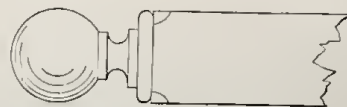
Perspective View  
of  
Mirror Bracket  
(Not drawn to scale)



Edge of Side shewing Mortice.



Corner Rail—full size.



Turned End - full size.







## ELECTRIC TOY-MAKING.

## HOW TO MAKE AN ELECTRIC HAMMER.

By ELECTRON.

**T**HE electric hammer is constructed on the principle that when a helix or coil of wire of suitable power is connected with the poles of a battery in action, an iron bar within it will remain suspended by induced magnetism, although the coil is in a vertical position, and if the bar is partially drawn out of the coil, it will, when released, spring back again. This power, the action of the coil upon the iron bar within it, is the power used.

Fig. 1 is a side view of the hammer, full size, the frame for supporting the coil is of cast iron, the anvil block being formed in the centre, on the top of frame, a circular flange  $1\frac{1}{8}$  inches in diameter is formed, on which the coil rests, the bottom of the frame is flanged out  $\frac{1}{2}$  inch on each side, and four holes drilled in it, by which it is screwed down to the baseboard.

The bobbin for the coil is of boxwood, the bottom flange is  $1\frac{1}{8}$  inches diameter, and the top flange  $\frac{3}{4}$  inch diameter, or it may be made by wrapping three or four folds of brown paper round a blacklead pencil  $\frac{1}{4}$  inch in diameter, and gluing the paper, then make two ends or flanges of boxwood, and glue them on the paper

wire, leaving a few inches at each end, for the connections, commence winding at the bottom end of bobbin; a small hole must be bored in the

flange, and one wire brought through it, two holes must, also, be bored at opposite sides of large flange, by which it is bolted to the circular plate on frame; the length of coil is  $2\frac{5}{8}$  inches. The hammer is  $\frac{1}{2}$  inch square at the lower end, with a shank  $3\frac{1}{2}$  inches long, and turned up to  $\frac{1}{4}$  inch diameter, the shank for  $1\frac{1}{2}$  inches at the lower end, has a flat filed on each side, and a small brass plate with

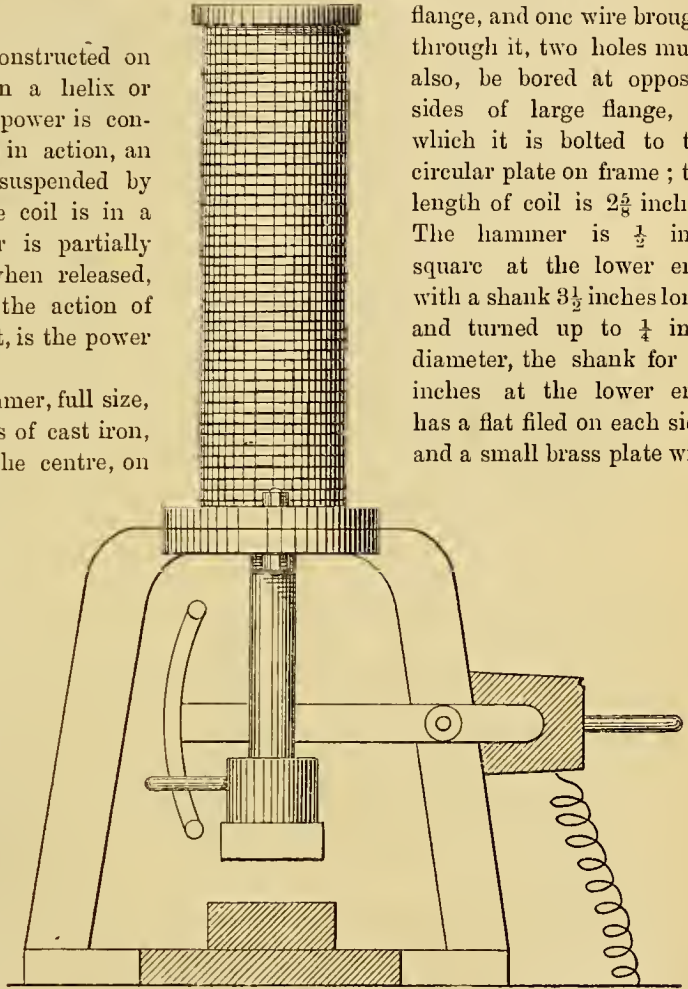
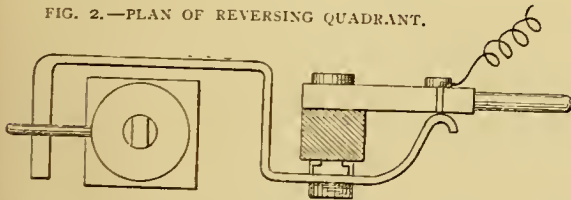


FIG. 1.—SIDE VIEW OF ELECTRIC HAMMER.  
FULL SIZE.

FIG. 2.—PLAN OF REVERSING QUADRANT.



tube; if the tube is made of paper, the pencil should be left in till the wire is wound on, to prevent the tube being crushed. Wind the bobbin with four coils of No. 22 silk-covered copper

a slot filed in it, is screwed to the underside of the circular plate on frame, the squared part of shank working in this, is prevented from turning round when working, a small pin is screwed into the head of the hammer, which works the reversing quadrant. The reversing quadrant is of iron, and is bent into the form shown in Fig. 2, the end where curved, works on a brass pin fixed in a piece of ebonite  $\frac{1}{8}$  inch thick, shown in Fig. 1,



and to which a wire is fixed, same size as is wound on the bobbin, the other end of quadrant has two pins, which are worked up and down by the pin in the hammer, the centre of the quadrant works on a small bolt, with a milled-headed nut, which passes through frame and the piece of ebonite, and which keeps the curved end in contact with the pin in the ebonite, a brass pin is also screwed into the end of the piece of ebonite, by which it can be moved up or down.

A baseboard of mahogany, 4 inches by 3 inches, varnished or polished, must be made to which the frame is screwed, at one end of baseboard fix two binding screws, and connect to one of them the wire from one end of coil, and to the other the wire from the piece of ebonite, the other end of wire from the coil is put through a small hole in the circular plate on frame, a loop is made in the end, and it is screwed against the circular plate by one of the screws which fasten the coil to the plate; the ends of all the wires where connected, must have the covering taken off and the wire cleaned with a piece of emery cloth, the ends connected to the binding screws are carried in grooves on the underside of baseboard, and soldered to the screws underneath. The piece of ebonite must be set, so that when the quadrant is lifted to the highest point, by the pin in the hammer, the curved part is just clear of the end of brass pin, to which the wire is connected.

The binding screws are connected to the poles of a battery, and the current passes from one screw round the bobbin, and back through the frame, along the curved arm of quadrant, to the pin in the piece of ebonite, and through the wire from it to the other screw; this causes the hammer to be drawn up into the coil, the pin lifts the quadrant, and moves the curved end off the pin, which breaks the contact, the hammer then drops by its own weight, and in falling brings down the quadrant, which moves the curved end upon the pin again, and contact being again made, the hammer is again lifted, and so on alternately making and breaking contact. The hammer works with great rapidity.

## AMERICAN ORGAN BUILDING.

By THOS. L. WINNETT.

### II.—THE CASE—SELECTION OF WOOD FOR SAME—DETAILS OF CONSTRUCTION—THE SOUNDBOARD—FIXING THE BELLOW IN POSITION—THE WIND-CHEST.

**B**EFORE proceeding to the next stage of our organ construction, I should like to describe to those who have not yet completed the bellows, a better way of hingeing on the lifters. Iron and brass hinges are liable at times to add a musical note or two on their own account, not quite in tune with the rest of

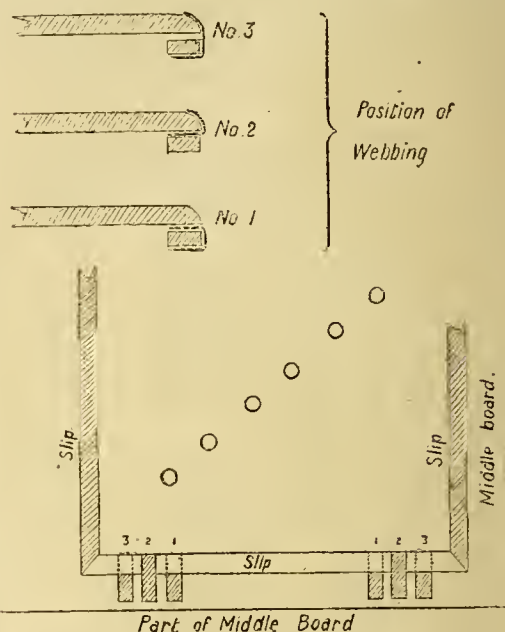


FIG. 11A.—METHOD OF FIXING WEBBING HINGES TO BELLOW LIFTERS.

the instrument, and calculated somewhat to try the temper of the musician. To obviate this, hinges made of strips of webbing may be used with advantage. Fig. 11 A is a view of half the middle board, with the slips in position, and shows the method of fixing the pieces of webbing. Cut six pieces of  $1\frac{1}{2}$  inch strong webbing for each lifter, 6 inches long. Pieces Nos. 1 and 3 are to be fixed *under* the bottom slip before it is glued down; No. 2 to be glued and tacked on the *top* of slip. Before laying the lifter in place, fold No. 1 over the slip. Then lay on the lifter. Pull up Nos. 2 and 3 as tight as possible, and glue and tack on to the rounded edge of lifter. Turn lifter back and fix the No. 1 on to the

inside surface. Then proceed to cover the bellows as before described.

Presuming that we have constructed the bellows in a satisfactory manner, and made all parts perfectly air-tight, we will now consider the means of fixing them in a case.

The question for us now to decide is, Shall we go in for an expensive and elaborate case, or be content with one of pine or some hard wood? The former, of course, will cost much more, and if the work be carried out in a workmanlike manner, the instrument will be a fit ornament for any drawing or dining-room. But this must be left entirely to the individual taste of the reader. I have given, in Fig. 15, a drawing of a very elegant case, side view. It is the same design as my own instrument, therefore, quite practicable to any ordinary worker, and is much more simple in construction than it appears. It is to have a pipe top; that is not included in this drawing, but the whole instrument is shown complete in the Coloured Illustration with Part 13.

In pipe organ building, it is not usual to make the case until the whole interior mechanism has been completed; but for us, it will be necessary to finish the sides of the case before anything else can be fixed, which you will no doubt see further on. Black Canadian walnut is the best wood for our purpose. Stained very dark and polished dead, it has a splendid effect, and looks very elegant in contrast with the ivory keyboard.

The thicker the wood used the nicer and more massive will the whole instrument look; therefore, I should advise, in this style of case, not to use anything less than  $1\frac{1}{2}$  inch stuff, when planed up. But  $1\frac{1}{4}$  inch will do, if we must cut down the expense a little. Although I always think that if the instrument is to be a permanent one, to last our lifetime, it is a pity to "spoil the ship for a ha'porth of tar."

I have found that the best wood is to be obtained of some cabinetmaker in a town; but if that is impracticable, there are plenty of dealers in London who would quote the price on application. Messrs. Melhuish and Sons, *Fetter Lane*, have some splendid walnut always in stock, although it is somewhat dearer than cabinetmaker's prices. Mr. G. H. Marsh, of

29, Temple St., Bristol, will supply the whole of the wood required for the work for 50s.

Having decided on the wood, we will commence work. To begin with, we shall require for the main side, two pieces, of say,  $1\frac{1}{2}$  inch stuff, 1 foot 10 inches wide, and 3 feet 3 inches long each. You will see, by looking at Fig. 15, that the side is constructed in the form of a frame, enclosing the panel, *g*. The part, *b*, is called the scroll end; *a*, the stile, and *c, c*, the rails top and bottom.

The size of the piece required to be cut off for the scroll end will be 3 feet 3 inches by 1 foot 2 inches. The wood will be rough when it comes from the dealer; it will, therefore, be necessary to plane up the two sides smooth. If you are not a good hand at planing, it would be a great saving of labour and patience to have it done for you by some good carpenter or cabinet-maker; it will then be ready for you to carve out the ornamental front.

The best way to do this I have found is to cut out paper patterns exactly the size, and paste on the wood; then, with a hand turning-saw, carve out roughly, taking care, when turning the corners of trefoils, not to allow the saw to yield to the tendency it usually has to run out of the square. This part of the work is very slow, and will make your arm ache, but with a little patience, it can be got through satisfactorily. The saw must be slightly oiled every few minutes, as the wood being so thick and hard, the friction takes the temper out of the saw, which will bend up into the most fantastic shapes if it gets too hot. In Fig. 16 I have given a drawing of a very good saw for the purpose, generally known as a keyhole saw.

The side having been cut out roughly, we must plane up the opposite edge, and prepare it for receiving the rails, *c, c*.

These rails, as you will see by the dotted lines, are mortised into the stile, *a*, on the one side, and into the scroll, *b*, on the other. I shall not describe in detail the process of the framing together, as I presume you are by this time pretty well acquainted with the rudiments of cabinetmaking.

The mortise must go right through the stile,

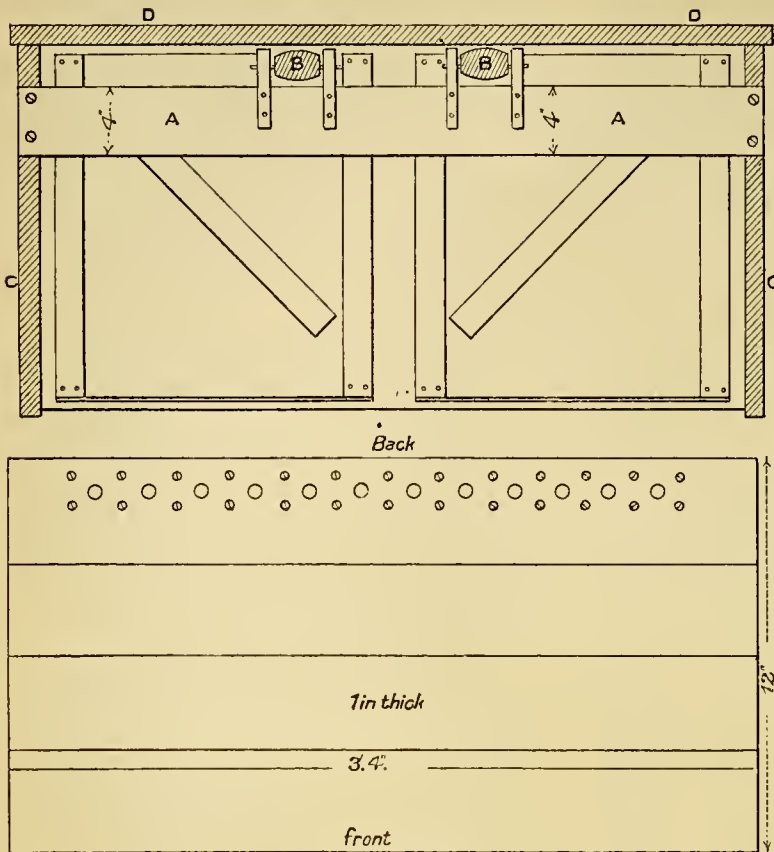


FIG. 12 Sound board.

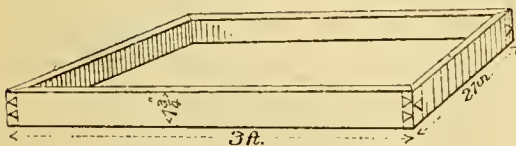


FIG. 19 Wind Chest

A, but only to the depth of 2 inches into the scroll end, B, the latter fastened with two dowels, put in from the side which is to form the inside of the instrument, taking care not to send them right through to the other side, as it would look rather ugly. I need hardly say that the joints, outside, at any rate, must be made very neat, and the whole frame true. It is not very likely to wind when cramped up, on account of the thickness of the wood, unless the edges have been made very much out of square, or the mortises not cut straight. Use best glue for framing

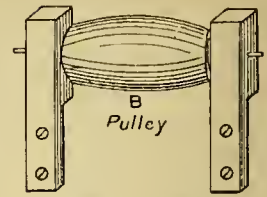


FIG. 14 Front of Bellows showing Pulley

A. Bearer for Pulley  
B. Pulleys.  
C. Side bracket.  
D. Sound-board

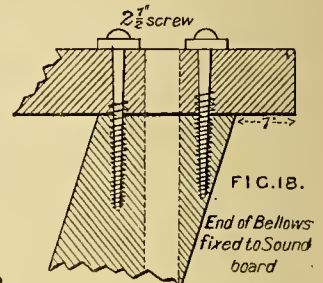


FIG. 18.

End of Bellows fixed to Sound board

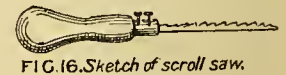


FIG. 16. Sketch of scroll saw.



FIG. 17. Scratch tool or Reader

together, and cramp it up for twenty-four hours. Of course, before finally putting together, the panel, A, must be let into a groove, made  $\frac{1}{2}$  inch from the front surface, and the chamfering, shown in Fig. 15, must also have been previously done. The thickness of the wood for the panel is quite optional,  $\frac{3}{8}$ th inch I have used myself. Instead of the chamfering, a small moulding may be run round, if preferred. I like the look of the chamfer myself best, it being more artistic, and more in keeping with the style of furniture now in use.

When the jointing is dry, we may take it out of the cramps, and finish on the flat surface with a sharp smoothing plane. The carving of the scroll end can now be finished off. The most useful tools for the purpose are, first, a spoke-shave, and if you have to buy one, get it with regulating screws; a 1 inch chisel is in-



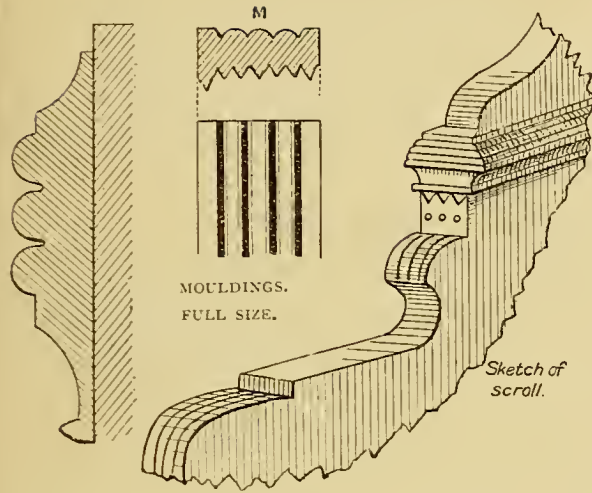
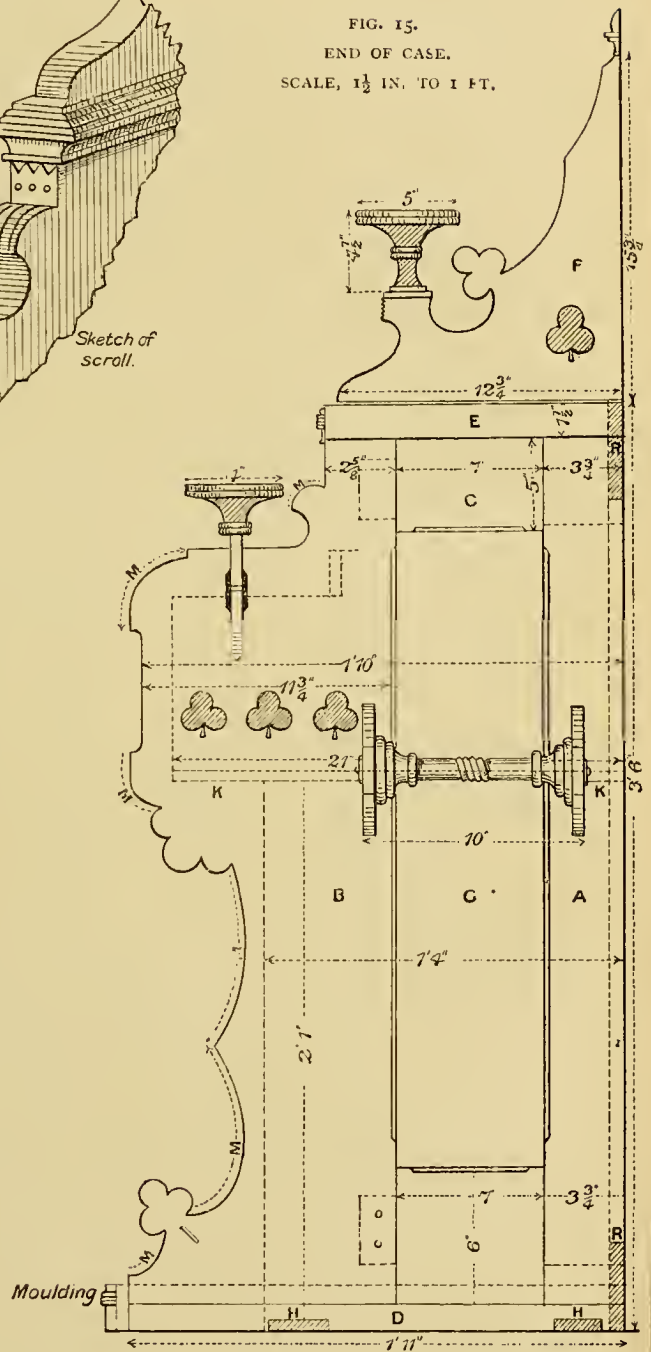


FIG. 15.  
END OF CASE.  
SCALE,  $1\frac{1}{2}$  IN. TO 1 FT.



dispensable, and a wood file, flat on one side and half round on the other.

Get every edge perfectly square with the side. This can only be done by keeping the square constantly in use. It looks very bad if in the least out of the true. When we have got the edge to our satisfaction, a moulding must be cut on it in places. A section of the moulding is shown at *m*, in Fig. 15, and the various parts of the edge to be moulded are marked by the same letter. The sort of tool best adapted for this work is what is known as a reeder or scratch tool. I have an iron one, which I bought of Melhuish and Sons, *Fetter Lane*, and I would not be without it now for ten times its cost, about 3s. 6d., I think. Any shaped moulding can be made, either by buying new reeds, or making them yourself out of spring steel with a few files. Two or three, however, are sent out with the tool. A sketch of one has been given in Fig. 17. In one or two places you will find that the reeder will not have room to work; finish this off neatly and carefully with a very sharp chisel. The effect of the moulding, shown at *p*, Fig. 15, is very good, and is very much used by American organ manufacturers.

The three trefoils at the side of the organ are to be cut about  $\frac{1}{2}$  inch deep with a centre-bit, and the bottom of each hole filled up with a thin piece of walnut to hide the marks made by the middle of the centre-bit cutter. Stain and polish the pieces *before* they are finally fitted in, as they cannot be done so well afterwards.

The top and bottom of each scroll end must now have a strip of walnut,  $1\frac{1}{2}$  in. deep, fastened on securely (*n* and *e*, Fig. 15), of the same thickness as the other parts of the side. This will extend the side to its full height, 3 feet 6 inches. The joints, top and bottom, will be hidden by a piece of moulding, further details of which will be given later on.

This side completed, we must make another, *precisely* similar. Stand the two ends side by side to see that each is perfectly perpendicular to the ground, and test the top with a spirit level. If this is satisfactory, draw a horizontal line on the *inside* of each part, 2 feet 1 inch from the bottom, and at that distance, cut out with the

tenon saw, a groove (shown by the dotted line at *k*, Fig. 15),  $\frac{1}{2}$  inch deep, 1 inch broad, and 21 inches long, starting from the stile end. Make the grooves exactly the same depth ( $\frac{1}{2}$  inch) throughout. This can be ensured by using a tool not much required in the amateur workshop, but known to carpenters as an "old woman's tooth."

Putting our organ ends away for a short time, we will set about making a soundboard (see Fig. 12). It consists of a plain deal jointed board, 3 feet 4 inches long by 21 inches wide and 1 inch thick. Groove and tongue the joints for security, making the surface perfectly true and edges square.

We shall next want two pieces of  $\frac{3}{4}$  inch stuff, cut into the shape shown at *e*, Fig. 13. These are the bellows brackets, and are to be made to the dimensions shown in Fig. 13; *a* is the middle board of bellows, end view. To this board at each end our brackets must be screwed firmly with three large screws, in the position shown in the illustration. The part cut out at *e*, Fig. 13, is to carry a bearer, Fig. 14, which in its turn carries the pulleys for the bellows, *b*. The dimensions of the bearer are, 3 feet 3 inches long, 4 inches wide, and 1 inch thick. The pulleys I need not describe, as you will easily see what they are by reference to Figs. 3 and 14. The rollers will have to be turned in a lathe, and should be made of some hard wood, preferably box.

These being fixed in position, and the two remaining springs fixed, as in Fig. 3, to close the feeders, the bellows are ready for attaching to the soundboard, Fig. 12. Glue a strip of thin leather on the top of the bellows where the twelve holes are, cutting out the holes with a penknife when dry.

Going back again to our carved ends; on the stile of each end on the *inside*, make a rabbet (*r*, Fig. 15) 1 inch wide and  $\frac{1}{2}$  inch deep, from top to bottom. This is to take the back when the organ is finished. This done, we will place them in position to receive the soundboard and bellows. Place them perfectly upright, on a level floor, testing with a plumb line and square. The distance between them *everywhere* must be 3 feet

3 inches *exact*. Prepare two strips of walnut (plain wood will do, as it is not seen at the back), 3 feet 5 inches long,  $\frac{1}{2}$  inch thick, and 4 inches broad. They are to be fixed with four large screws at the top and bottom of the organ (K, Fig. 15), thus joining the two sides together. Similar strips must also be fixed at the bottom (H, Fig. 15). A rabbet need not be cut right along in this case, but the ends simply let into the bottom. It will be a stronger job, perhaps, if the ends appear right through, giving more screw hold; they will be hidden by the 2 inch moulding, which we shall afterwards run round the bottom of each end.

Now the soundboard should slip into the grooves we made in the two ends, and fit tightly therein. It is important, too, that this board, being the foundation of all the action, should be made perfectly level. It will be so if we have cut the grooves correctly in the first place. The bellows can next be placed in position, and if we have made the measurements right, the sides of the brackets should fit into position between the two ends without any difficulty, reservoir side, of course, at the back.

To fix the bellows to the soundboard is the next job. It will require a little help in the shape of an assistant to hold the parts in position. Keeping the parts still fixed in the case, place the top of bellows close to the underside of soundboard, leaving a distance of 1 inch at the end of the soundboard (Fig. 18). This should allow the bottom of reservoir board to just clear the rabbet line we made to take the back of case; if it is just inside, well; if not, our bellows measurements have not been exact, and we must take a little more than an inch to remedy the defect; but do not resort to this, if you can help it, as it will throw out all the other parts afterwards. Having, by means of a piece of paper and blacklead, previously found out the position of the holes in the top of the bellows, cut out holes in the soundboard to correspond (Fig. 12). The two parts may now be screwed together, if we are sure the position is right. Bore the fifteen screw holes very carefully in the places marked in Fig. 12, taking care not to open any cracks in the wood. Use No. 12 roundhead

screws,  $2\frac{1}{2}$  inches long, and brass washers  $\frac{3}{4}$  inch wide. The latter can be obtained at any piano-forte dealer's for a few pence.

The last piece of work I shall describe in this chapter will be the wind-chest frame, Fig. 19. It consists, as you will see, of four pieces, dovetailed and mitred at the corners. This is the strongest way of putting it together, but if you are careful about making the corners perfectly air-tight, it may be done with square edges screwed together, or else the two ends let into the sides  $\frac{1}{2}$  an inch, gluing small blocks of wood inside to ensure its air-tightness and strength. The size of the frame is to be of the same dimensions as our reed or cavity-board, 3 feet long and 21 inches wide. The stuff used must be 1 inch wide, and the height or depth of frame,  $1\frac{3}{4}$  inches. Be very careful to make the top and bottom edges perfectly square and true. The bottom of the frame is to rest on the soundboard, and the top to carry the reed board.

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## HINTS ON GLASS DECORATION.

By A. SAVIL.

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“RUSHED” or “Broken Jewels” is the name given by an American artist to a very beautiful application of coloured glass, and a very good idea of the effect is conveyed by the name.

Americans claim to have brought about a Renaissance in the art of glass-painting, and, certainly, they have introduced a new style both in the treatment and application of glass as a material for producing pictures and beautiful combinations of colour.

In June last, I had the good fortune to visit an exhibition of American art works at Messrs. Johnstone and Norman's, *New Bond Street*, and there, among other charming exhibits, were to be seen some specimens of stained glass, by Mr. John La Farge; and although they were merely sample panels hung in windows, they were beautiful in themselves, and, I believe, quite unique in their way. They gave one the idea of precious stones, grouped and set in harmonious designs, and, especially with the



sun shining through, the effect was gorgeous but refined, without the least approach to gaudiness. There were, to all appearance, emeralds and amethysts, the topaz and opal blending in a manner delightful to the eye, and giving some idea of what a large window composed of such material would be.

In some instances the glass is broken up into irregular shapes; in others, the perfect gem-like effect is maintained, while, perhaps, the most charming results are arrived at by breaking small balls of coloured glass, so that the light is reflected by their fractured parts. The glass is fixed in a lead groundwork, in which it seems

and being very thick in its lower extremities, when smashed up supplies a very jewel-like material. There is, also, in every Champagne bottle one treasure, situated in the centre of the inverted cup-shaped base; this consists of a round "bull's-eye," nearly an inch thick, which is easily detached from its surroundings by the aid of a hammer.

Next, there were tall, thin Hock bottles, of a beautiful orange-brown tint, the thicker portions of which afford excellent specimens of a "gem," the exact name of which I cannot recall just now, but which is most effective for the purpose in hand. Even the common soda-water bottle,

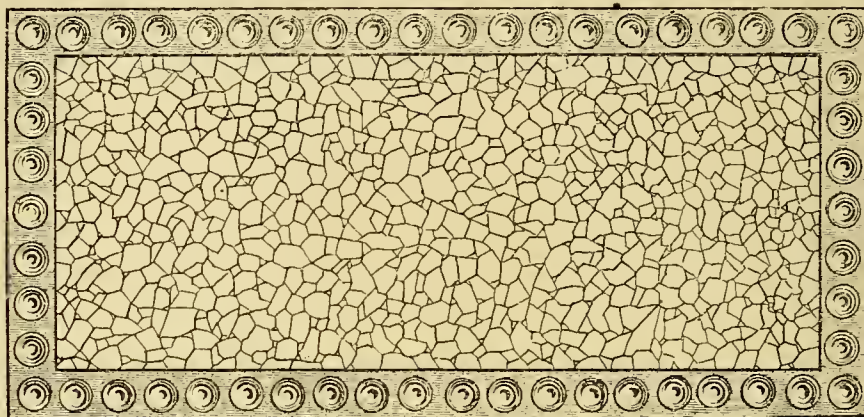


FIG. 1.—COLOURED GLASS PANEL OVER CASEMENT OF FRENCH WINDOW.

to be embedded by the use of punches for the most part. I do not pretend to know how it is done, but having seen these specimens, I determined to carry away the main idea "in my eye," and to try my hand at something of the same kind in a small way when I got home.

In the back yard of a friend's house I found a very great heap of old bottles and broken glass, of many years' standing—in fact, the bottles of several generations—and having obtained permission to ransack this heap to my heart's content, I managed to supply myself with, what we call in my country, "the makings" of "jewels" *galore*. This last word is Celtic for "more than enough."

In the first place, there were innumerable Champagne bottles. Now a Champagne bottle is composed of glass of a charming green shade,

when crushed at its base, supplies an admirable *aqua marina* or beryl, while every brandy bottle, *et hoc genus omne*, may be made to contribute a "jewel" of the same class, but smaller, and paler in hue, as that found in its brother from Champagne.

There are, also, various blue bottles in which certain medicines, etc., are made up, chief amongst them being the castor oil bottle, which are to be had in all sizes, from the tiny phial to the imperial pint; and these supply specimens of beautiful blue "stones," of varied depth of shade. Besides the treasure to be found in bottles, in such heaps of broken glass as that from which I obtained my materials, there are always odds and ends—especially ends—of miscellaneous articles, such as vases, lamps, coloured wine glasses, etc., etc., which may be turned to

account. Having thrown out these suggestions, I now proceed to speak of the use to which I put my treasures, in the hope that some of our readers may be benefited thereby.

Suppose, then, a French window in a drawing-room, over each casement of which there is a narrow fixed pane, 18 inches by 8 inches.

These spaces I filled with coloured glass panels (Fig. 1), and the result is much admired by all who see it.

First, I prepared several dozen of the Champagne bottle "jewels" by chipping off the

three inches being sufficient—filled with very fine damp sand or earth. The surface should be made perfectly smooth and level, being pressed down with something flat and heavy. The smoothing iron will here again suit admirably. Next, place the tin frames in position upon the surface of the sand, etc., seeing that their sides are parallel and exactly  $1\frac{1}{4}$  inches apart at all points. Now, with a piece of flat board, press the frames gently into the sand to the depth of about  $\frac{1}{8}$  inch, being again very careful that they are both in the same plane, and also that the

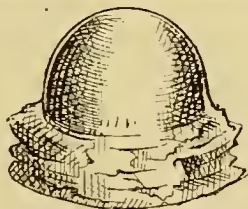


FIG. 2.—"JEWEL" READY FOR SETTING.

FIG. 3.—BOX WITH TIN FRAMES IN POSITION, FOR ARRANGING THE "JEWELS."

remains of the bottom cup which surrounded them when the bottle was broken. This was done with the flat end of a common hammer and an old smoothing iron, the latter being used as an anvil. Fig. 2 represents one of these "jewels" when ready for setting.

I next cut strips of tin-plate  $\frac{1}{2}$  inch wide, and with these I made two rectangular frames, one 18 inches by 8 inches, and the other  $16\frac{3}{4}$  inches by  $6\frac{3}{4}$  inches, or  $1\frac{1}{4}$  inches less every way than the former. The joinings of the tin strips should be soldered as flatly as possible, and the angles made exactly square.

The next requisite is a flat box, say, 20 inches by 10 inches, and any depth—two or

surface of the sand, etc., is not interfered with except where the edges of the tin are sunk. Fig. 3 represents the box with the tin frames in position.

Now take your bull's-eye "jewels" and arrange them between the frames, pressing them slightly into the sand in such a way that they shall lie evenly upon it, and only just sufficiently deep to ensure that the melted lead, presently to be poured round them, may not be able to find its way under the glass. Commence by placing one glass at each corner and then filling up the intervening spaces, placing the glasses so that they shall *just not touch* each other. Now melt a small ladleful of lead, and

using great caution, pour in the molten metal in such a way that it shall run all round each glass to a uniform depth of about  $\frac{3}{16}$  inch, but so that there may be *no break* in the lead until, having gone all round, you arrive at the point from which you started. This operation calls for some dexterity, but presents no real difficulty. Should the lead run over the rounded surface of the glass at any point, it may easily be cut away with a small carving gouge, etc., and the lead removed to the proper level.

The whole should now be removed from the sand, and the tin frames separated from the lead casting. The point of junction where the work of pouring the lead was begun and finished, should be firmly secured. This may be done by running a little soft solder into the joint on both sides, using an ordinary copper bit and a little resin as a flux.

Any unevenness upon the upper surface, or right side, of the lead may be removed by the application of a small  $\frac{1}{4}$  inch gouge, and if the whole surface be gone over with this tool, by a quick turn of the wrist giving it a zigzag motion, the appearance of the work will be much improved, and a uniform surface imparted.

The underside of the casting will be quite flat, and the glasses will be almost flush with the surface, which, if sand has been employed, will present a slightly pitted appearance, needing no further treatment.

Having made the frame or frames, I suggest a mosaic filling. Cut a piece of 26 oz. glass to fit the frame exactly, and lay it upon a flat surface, placing a sheet of white paper under the glass. Now cover the glass with a rather thick coat of gum-arabic—of course, the glass must be perfectly clean, and the gum as strong as possible—and from your store of coloured glass select the best and flattest specimens.

With the hammer and smoothing iron, as before, form irregular-shaped pieces of various sizes, and proceed to form the mosaic by placing these, flattest side down, upon the gummed surface of the glass: supply more gum where necessary with a soft brush. Be careful to avoid allowing any pieces of mosaic to project beyond the edge of the glass, and endeavour to fill all

interstices, or rather, to fit the mosaics, so that there may be few interstices.

The greatest latitude is allowable in the arrangement of the coloured pieces, and there is unlimited scope for harmonious effects.

The fragments of Champagne bottles supply many tones of green; the Hock bottle is rich in browns and amber tints, which, with here and there a suspicion of castor oil bottle, and other “gems,” will be found to produce charming results. In placing the pieces, be careful not to allow any gum upon their upper surfaces; but a liberal amount may be used in embedding them on the glass and upon their sides.

When the panel is covered with mosaic it may be laid aside to dry in the open air, or in a warm room; or an additional effect may be produced as follows:—

Take fragments of all the coloured glasses at your disposal, and pound them up in a metal mortar, or otherwise, until the largest particles are about the size of the crystals of common coarse salt; now remove the dust and very small particles by sifting the whole in a wire sieve, as used for cooking purposes; distribute the coarser particles left in the sieve, evenly over the whole surface of the panel, being very careful not to move the pieces of the mosaic, but in such a manner that the granulated glass may find its way into the crevices, which are partially filled with wet gum.

For this operation it will be necessary to have a much greater supply of the pounded glass than is actually required to fill the interstices; but when dry, the superabundance will fall off, and any chance particles which may adhere to the surface of the pieces which form the mosaic may be easily removed.

There are many objections to the use of water gum for this purpose, the principal being, that it may suffer from damp, and that it “will not wash;” but if, when perfectly dry and hard, the panel is given a coat of clear mastic varnish or French oil varnish, I think that it will resist any dampness likely to be present in a sitting-room, and that the varnish will also protect the gum from the other and opposite danger, of cracking from overdryness.



I have tried various other substances to fix the mosaics upon the glass, but find that all varnishes, etc., however hard-drying under ordinary circumstances, are effectually prevented from setting thoroughly by the fact that the glass protects them from contact with the air.

However, my remarks in this paper are merely suggestive hints, and perhaps some of my readers may hit upon a better plan.

## DIVIDING ATTACHMENT FOR LATHE.

By D. G. TAYLOR.

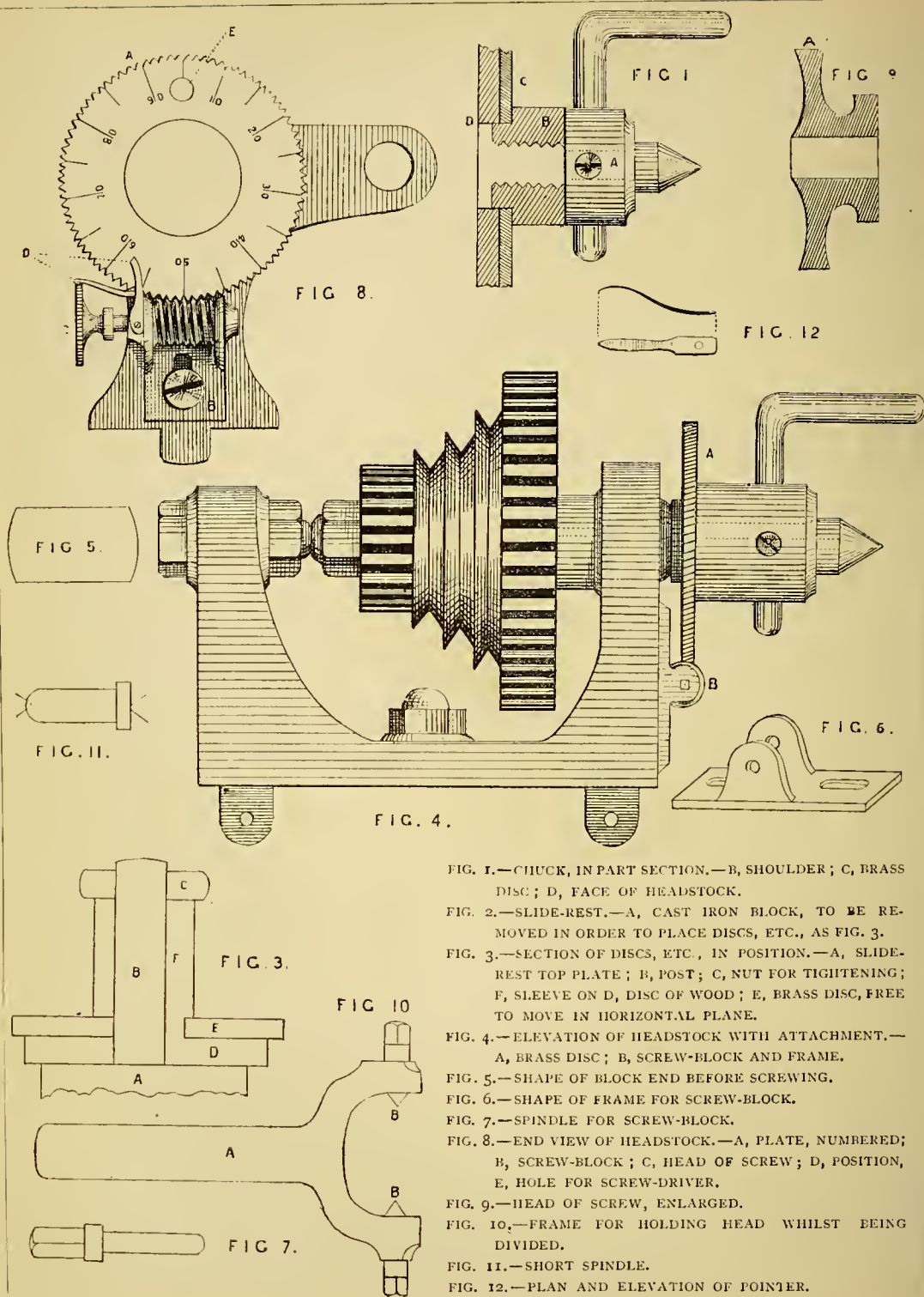


HEREWITH give drawings and description of a dividing attachment for dividing in the lathe instead of the ordinary division-plate with concentric circle of holes and index peg. It is specially adapted for small lathes where a full-sized division-plate as above-mentioned, could not be attached.

It consists of a worm gear fastened to the mandrel, in this case by attaching the toothed disc to the back of a chuck, the screw or worm being fastened to the front face of the headstock in such a manner as to slide up and down to gear with the toothed disc, the head of the screw (not shown in elevation, Fig. 4, but shown at c, in Fig. 8) being divided into a suitable number of divisions, as will be explained later on. The screw, in this instance, is a short length of  $\frac{3}{8}$  inch Whitworth screw, which contains eleven threads to the inch. The pitch is quite immaterial, a coarse thread having a better grip on the toothed disc than a very fine one, and would give a sufficient number of divisions for ordinary purposes where a strong grip is required. Of course, by having a fine pitch, a larger number of divisions could be got from a plate of the same size, but the grip would not be as strong.

I will now proceed to show how to make the apparatus, which is really far easier, though entailing a longer description, to make than the ordinary plate with holes, and, as I have not seen any description of such a thing in this Magazine (which I have from the commencement, and cannot speak too highly of its merits), I

conclude this description would be of use to those about to fit division-plates to their lathes. The plate in this case has ninety teeth, which, with eleven pitch, will make it  $8\frac{7}{8}$  inches in circumference, or nearly  $2\frac{3}{4}$  inches in diameter, therefore, take a piece of  $\frac{1}{4}$  inch sheet brass, or a brass casting if preferred, and bore out a hole in the centre the size to fit the chuck on which it is to be used, which has a shoulder turned down for it, as shown in Fig. 1. Then turn a mandrel to fit this bore and drive the plate on it, and turn up the face and sides of it, making about  $2\frac{3}{4}$  inches in diameter. Then take a piece of thin steel, as used in ladies' dress-improvers, and cut off exactly  $8\frac{7}{8}$  inches, and turn down the disc till the two ends of this steel will just meet when wrapped round same. Now lay aside the disc for the meantime, and proceed to make the tool to cut the teeth, which is really what is called a hob tap, that is, a plug or master tap with the grooves cut spirally round instead of straight up and down. To make this, take a piece of stout  $\frac{5}{8}$  inch steel, centre and turn true to  $\frac{5}{8}$  inch, then, with a good stock and dies (if the lathe is not screw-cutting, or has not a traversing bar), cut a good full thread (about six threads is enough), and cut the grooves out spirally with a small round file, and harden as for a turning tool. Next, if your slide-rest has a tool-holder, as Fig. 2, take off the block, A, and turn a hard wood disc,  $1\frac{1}{4}$  inches in diameter, and of such a thickness as to bring the centre of the edge of the brass disc, when placed on top of it, to the same height as lathe centres. If the hole in the disc is larger than the centre pin of slide-rest, turn out a sleeve of boxwood, as at F, Fig. 3, so that the brass disc may revolve freely in a horizontal plane without shake. Blacklead both wood disc and sleeve where the brass disc comes in contact with them, to reduce friction, and place them in position on top of rest, as at Fig. 3. Now place the hardened hob tap in the lathe, with a carrier on one end, and feed the rest, with disc in position, till tap and disc just come in contact, then set the lathe in motion, and the slightest touch will feed the disc round and show at once if the right number of teeth will come out without overlapping. Be ex-



ceedingly careful that the number required does come out, and not one more or less, or it will upset all your calculations. I may say here that the reason I adopt ninety teeth is that if the screw is turned a quarter of a revolution each time, we at once get three hundred and sixty divisions, or the degrees in a circle, which is exceedingly useful. If you find you get one tooth less than you calculated, you had better lay the disc on one side. It is not, however, wasted, as, by turning down slightly, it will fetch a different number of teeth. However, as ninety teeth is now supposed to be wanted, any other number is of no use at present. If one or more teeth than required are scribed on the rim of the disc by the hob tap, turn the edge down slightly; but if great care is taken to measure the circumference with the steel strip, which is exactly the right length, the right number of teeth will come out exact. Having got them exact, feed the rest up very slowly till the teeth are fully cut and the disc is ready for attaching to the chuck by three small countersunk screws.

Now we will proceed to make the screw for feeding or turning the disc round. Take a piece of good iron or steel,  $\frac{3}{4}$  inches diameter and 2 or 3 inches long, and chuck it independent of the back centre. Bore a  $\frac{1}{4}$  inch hole in the centre as it runs in the lathe, about  $1\frac{1}{4}$  inches deep, and cut off a full inch of it. Drive it on a mandrel and turn out side to  $\frac{5}{8}$  inch full, and turn the ends, as Fig. 5. Cut a thread on this as for the hob tap. Having done this, drive out the mandrel and lay on one side for the moment.

We will now turn our attention to the frame in which it is to work. This may either be made by bending a piece of  $\frac{1}{2}$  inch brass to shape, or getting a brass casting, the latter being preferable. File it up to shape, as in Fig. 6, then file two slots, as shown. These are to allow vertical adjustment. Then bore a  $\frac{1}{4}$  inch hole through each lug to take the spindle of the screw. The insides of the lugs should be

filed out so that the screw-block fits exactly; in fact, stiffly, without any play whatever. Next turn out a spindle to a tight fit in the screw-block and a good bearing fit in the brass lugs. To make the square on the end of the spindle for the head, scribe four lines at equal distances in order to get a correct square, the centre of which is the centre of the spindle, otherwise the apparatus will not divide truly. Fig. 7 shows this spindle. Now place the screw-block in position and drive the spindle in, keeping the square at the near side of the frame when fixed in position, when it should revolve smoothly and stiffly, without any shake at all, but not so stiffly as to prevent turning with finger and thumb. The disc should have a hole, as at *E*, Fig. 8, to admit a small screw-driver to tighten the top screw. After the chuck, with disc, has

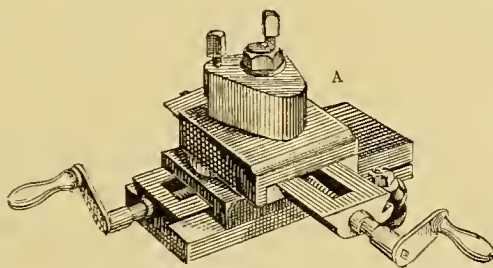


FIG. 2.—SLIDE-REST.

been screwed into position on the mandrel, bring the hole in the disc opposite the screw and push up the screw-block slide till the threads of the screw gear firmly with disc without any shake. Then screw frame to headstock firmly. I

ought to have mentioned before that the teeth in the disc ought to be marked and numbered, as Fig. 8. Each mark, if continued, should pass through the centre of disc. We will now proceed to make the head of the screw. Get a brass casting, shape as Fig. 9, and drill a  $\frac{1}{4}$  inch hole through, and with a square drift same size as square on spindle drift a square hole through. If the drift is slightly larger towards the top end, the head can be driven on and turned to shape. Forty-eight is a very handy number for the head; one division gives  $\frac{1}{48}$ th part of the circumference. Taking the same hob tap as before it would be  $4\frac{4}{5}$  inches circumference. Measure this in the same way as the disc. Now for the frame on which the head is to be divided. Get an iron or brass casting or iron forging, as Fig. 10, and make a short spindle, as Fig. 11, and, with the two set-screws, set it in the frame. The exact form of frame is of no



consequence as long as the centre of the edge, A, Fig. 9, comes level with the lathe centres. Having it ready, mark forty-eight teeth, as in the disc, only let them be merely marks, not full teeth. Number these marks in 2, 4, 6, or 8, as fancy prefers. Then screw on to the frame a small pointer, shaped as Fig. 12, with a point so shaped as to fit the marks with a slight spring, so that the jarring of the lathe may not shift the screw. A pointer is also required for the disc to mark the teeth revolved.

With a head divided into 48, the following numbers can be divided:—All numbers from 1 to 20, except 7, 11, 13, 14, 17, 19; and above 20: 24, 27, 30, 32, 36, 40, 45, 48, 54, 60, 72, 80, 90; above 90: 96, 108, 120, 135, 144, 180, 216, 240, 270, 360, 432, 480, 540, 720, 864, 1080, 1440, 2160, 4320. By adding a head of 42 divisions, the following extra numbers could be divided: 7, 14, 21, 28, 35, 42, 63, 70, 105, 115, 126, 139, 210, 252, 315, 378, 420, 630, 756, 945, 1260, 1390, 3780.

By having heads marked with 51, 57, 58, 66, we could get an equally greater number, but it would be quite unnecessary to go into each now. However, if any of our readers wish to gratify their curiosity, or otherwise, the way to multiply the number of divisions on the head by the number of teeth in the disc, and begin with the number of the teeth in wheel and try each one downwards. Each one that divides into that number without remainder, the quotient is the number that the circle can be divided into, thus:— $51 \times 90 = 4590$ ,  $4590 \div 34 = 135$ , a number that can be divided.

I hope I have made this perfectly clear, and, if any of our readers do not understand, and ask the question in the proper place, viz., "Amateurs in Council," I will endeavour to set them right. I must now apologize for going into apparently simple things to experienced engineers, but I write for amateurs and not experienced engineers.

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THE BEST WASHITA OILSTONES for carpenters weigh about  $1\frac{1}{2}$  to  $1\frac{5}{8}$  oz. per cubic inch, and a stone of standard size,  $1\frac{1}{4}$  by 2 by 8 in., should weigh about 1 pound  $6\frac{1}{2}$ – $7\frac{1}{2}$  ounces.

## ADJUSTABLE BAROMETERS : HOW TO MAKE THEM.

By JNO. H. MILNE.

### II. — BAROMETER WITH ZERO POINT — A CISTERN BAROMETER—DETAILS OF CONSTRUCTION AND ADJUSTMENT.



I will now describe a form of barometer with a zero point, which is a very convenient form of instrument.

The principle is that of adjustment, but this is accomplished by a mechanical arrangement, and not by an alteration of the scale. The scale is the usual one of 4 inches, marked off in inches, each inch being divided into tenths.

The tube is a siphon, and is fixed in the usual way to the baseboard by brass clamps; A, A, is a piece of wood which moves smoothly, exactly parallel with, and up and down, the tube. There is a spring, or other suitable contrivance, underneath A, A, by which A, A, is retained in the position it is set, and prevented from slipping. It moves up and down through the slots at c, c. At D, at the top of A, A, the scale and the pointer are placed. At the lower end of A, A, there is a fine pointer, B, just moving clear of the glass.

When it is wished to set the glass, A, A, is moved till B is level with the surface of the mercury in the short tube. The pointer is then set in the usual way, level with the surface of the mercury in the long tube. Suppose the mercury stands at 29. When the next observation is taken it may then be found that the level of the mercury in the long tube has risen above 29, and, consequently, the level in the cistern has sunk below the zero point in the short tube. The sliding scale is therefore brought down till the zero point is on a level with the surface of the mercury in the short tube. The true reading of the scale will now be found, and will be the difference between the pointer on the scale and the level of the mercury in the long tube, the zero point being at the same time level with the surface of the mercury in the shorter tube.

The construction of the mechanical arrangement of the sliding scale will be the only thing

necessary to describe to the reader, the other parts having been previously dealt with.

Assuming that the tube has been put in position on the baseboard, and neatly held by the brass clamps before mentioned, in order that the reader may be assisted in regard to the measurements, and adjustment of the movable scale, he should give the following explanation his attention.

Suppose he prefers as his tube a siphon  $\frac{1}{2}$  inch bore, the long tube measuring 34 inches, the short one 4 inches, which will be ample. Let him take as his highest mercury level for fine weather  $\frac{1}{2}$  inch from bottom of the lesser tube at E, which will be  $31\frac{1}{2}$  inches on the greater tube, measured from the bend, or 31 inches measured from E. This will allow  $2\frac{1}{2}$  inches vacuum from top of greater tube at the highest level of the barometer.

It is not well to have a small vacuum space at the top of the tube, as it is impossible to get a perfect vacuum, and air present in a small imperfect vacuum of, say, 1 inch, will be found to have considerable downward pressure, which will give a lower and false barometrical reading.

For every  $\frac{1}{2}$  inch the mercury falls in the greater tube, it will rise  $\frac{1}{2}$  inch in the shorter; thus the two will represent an inch fall, therefore, the utmost possible fluctuation in the shorter tube will be 2 inches, the same in the longer.

The lowest position of the mercury in the short tube will be  $\frac{1}{2}$  inch from the bottom, the highest  $2\frac{1}{2}$  inches from the bottom (leaving  $1\frac{1}{2}$  inches still free between the mercury and the top of the short tube). The highest level in the greater tube will be  $31\frac{1}{2}$  inches, leaving a fair vacuum of  $2\frac{1}{2}$  inches. The lowest level will be 2 inches below that. The movement, therefore, of the scale will thus be only within a space of 2 inches.

It may be taken for granted that in this climate the variation of the mercury is never more than between 27 and 31 inches. If it does vary to a greater extent, it is quite abnormal. However, in the above calculation, the  $\frac{1}{2}$  inch allowance over the lowest level in the less tube, and the  $1\frac{1}{2}$  in. over the highest will allow for this.

A fall of the extra  $\frac{1}{2}$  inch at the bottom of the short tube will really represent the barometer as standing at 32, while, on the other hand, the long tube will give ample margin for an abnormal rise in the short tube, and fall below 27 on the barometer.

It will now be seen that the adjustable scale should be made 31 inches, measuring from the zero point to the 31 on the scale. One inch extra, perhaps, being allowed for fittings, for the pointer to be fixed over the scale.

We will now describe the construction of the adjustable scale.

Procure a piece of wood, of the particular kind chosen for the instrument, say, 31 inches long, 1 or  $1\frac{1}{4}$  inches broad,  $\frac{1}{4}$  inch thick.

Obtain another piece, say, 6 inches long, 3 inches broad, and  $1\frac{1}{2}$  inches thick. The edges, for appearance, can be rounded, as in Fig. 5, a, which represents the back or underside. A groove can be cut to within  $\frac{1}{2}$  inch of the top, so that the long narrow piece can fit nicely into it. The long piece must be firmly glued into the top piece, so that they shall be square and their edges parallel, as in the figure. Then carefully smooth them down, so that when the back of the long piece lies flat on a smooth surface, the head or broader piece may do so also.

It is better to make the joining stop at A, and not be carried right through, otherwise a bad appearance will be given to the upper part of the work.

Fig. 6 represents the front view. The scale should be evenly glued on the wood, as represented. The adjustable screw, described in a former article in last volume as a pointer or indicator, is represented by the vertical line parallel with the scale, while the zero point is shown at a. This point can be easily made from a piece of brass, of the shape shown in the diagram, with an upper straight edge. When this is screwed to the wood with small brass-headed screws, it looks extremely neat, especially if lacquered.

In order that the scale may move evenly up and down, and yet remain in position at any point, the following plan is simple and effective. Get four pieces of brass, say,  $2\frac{1}{2}$  or 3 inches

long, about  $\frac{1}{4}$  in. broad, and  $\frac{1}{16}$  in. thick. Place them as in the diagram parallel, with about  $\frac{3}{16}$  or  $\frac{1}{4}$  inch space between them. These can ultimately be screwed down to the sliding scale with round-headed brass screws. The space between the brasses must be neatly cut out as grooves. Now the reader will see that when

scale, but left until a later stage, as it would then be more readily understood. It is the spring to hold the scale in position.

In Fig. 5, in which the back of the scale is shown, it will be seen a line is drawn on both sides of the slots, which represent springs, to hold the slide in position. Fig. 5, b, gives a

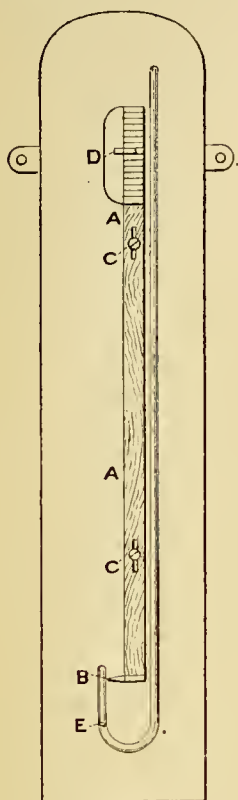


FIG. 4.

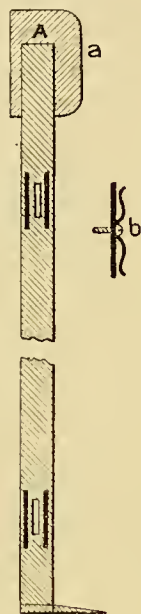


FIG. 5.

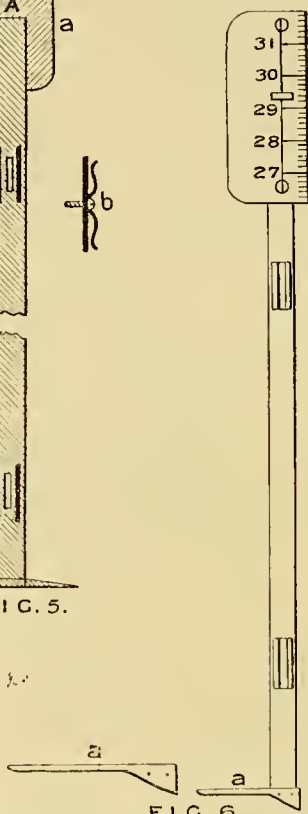


FIG. 6.

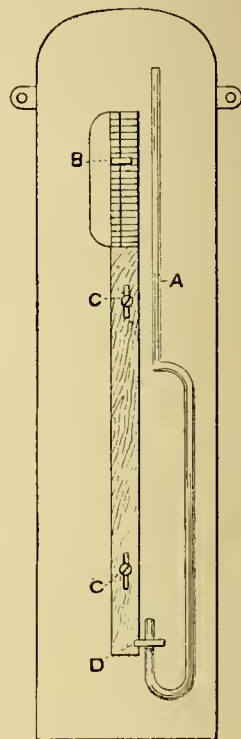


FIG. 7.

FIG. 4.—DETAILS OF SIPHON BAROMETER—A, Sliding Scale; B, Pointer; C, Slots; D, Pointer; E, Lowest Level of Mercury in Short Bend of Tube. FIG. 5.—ADJUSTABLE SCALE, BACK VIEW. FIG. 6.—ADJUSTABLE SCALE, FRONT VIEW—a, Pointer. FIG. 7.—SIPHON BAROMETER WITH BENT TUBE—A, Tube; B, Regulating Screw or Pointer; C, Slots with Screws through; D, Zero Point.

the scale is put in position close to the glass tube, and the stout brass-headed screws are screwed down through the grooves, so far as to allow the wooden scale to pass up and down in the grooves, to the extent of the opening between the brasses, the desired movement of the adjustable scale will be obtained.

One thing remains to be described, which was not noticed in describing the back of the

side view. The springs are pieces of clock spring, or tempered brass, fixed by a screw to the slide through the middle. A slight hollow is made in the wood, to allow the scale to fit close to the baseboard, but yet by means of the spring to press against the screw heads.

The springs can be placed as most convenient, but are best near the screws they are intended to press against. Two will do, or, preferably, if the



reader's breadth of sliding scale allow, as in the figure, one on each side the screw heads and immediately under the brass slides on which the screw heads work. This will be found to give the most exact movement.

The ends of the spring should be turned up, so as to prevent scraping the wood, and the reader is advised, as an easier movement is so obtained, to let into the base-board a plate of brass, upon which the springs may press, instead of against the wood of the baseboard.

If the tube used is bent, as in Fig. 7, then, of course, the zero point will be on the same side as the pointer, and the sliding scale can be made to move up and down close to the glass.

Fig. 7 represents the completed instrument, which, if the parts are carefully finished, and, for neatness it is suggested the corners be rounded off, then the whole completed by French polishing, or varnishing, as described in Article I., the result will be an exact and presentable barometer.

The following is another form of adjustable barometer, called the "Cistern Barometer." It consists of a tube standing in a cistern of mercury. The scale is a full 4-inch one, and the instrument is constructed precisely as that described in a former article on "The Barometer" in last volume, with this difference, that the cistern there described is fixed, while that now being described is movable or adjustable.

Take Fig. 8, a is a brass knee or angle screwed to the baseboard. Fastened to this is a

peg of ivory, or bone; b is the level of the mercury in the cistern; while c is a screw, which on being turned raises or lowers the cistern. The dotted circle represents the cap; the lesser circle being a glass face in order to admit of the zero point being seen; d is the tube.

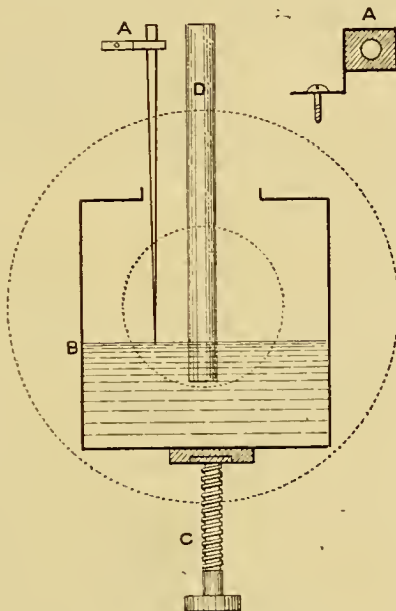


FIG. 8.—CISTERN BAROMETER.  
A, Brass Knee or Angle carrying Pointer;  
B, Level of Mercury in Cistern; C, Screw  
to raise or lower Cistern; D, Glass Tube.

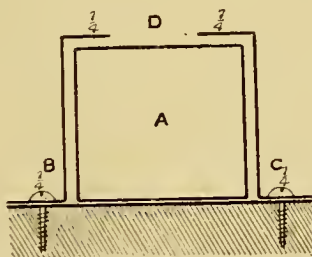


FIG. 9.—PLAN OF MOVABLE CISTERN MADE  
FROM A GUM BOTTLE.  
A, Bottle; B, C, Clamps; D, Front of Bottle.

It will be clear to the reader that if instead of moving the scale up and down while the tube is fixed, the same result can be obtained if the scale and tube are fixed, but the cistern is movable. Of course, the movement in the cistern will be much less, in the proportion of its superficial area to that of the tube.

If it is wished to set the barometer to-day, the cistern is lowered or raised till the zero pointer just touches the level, B, of the mercury. The pointer on the scale is then set to the exact height of the mercury, say, 30 inches.

When the barometer is examined to-morrow, say it has fallen to 29 inches, it will then have risen above the level, B, in the cistern. The true level, therefore, is not the fall of 1 inch, but the cistern will have to be lowered, by turning the screw, c, until the zero point, A, is again just touching the level of the mercury at B, which will, of course, lower the level in the tube. The correct reading on the scale can be

now taken, when it will be found to be a fall in excess of an inch.

It will thus be seen the mercury is again measured between the two levels. The rule is to set the two pointers to the two levels, and on taking the next reading set the zero point to its

level, and the difference between the pointer on the scale and the level of the mercury will be the rise or fall.

In constructing this barometer the movable cistern will be the only part which will require explanation, the rest of the instrument being made precisely as the one described in the last volume.

The same kind of cistern will do as in the article mentioned. A very good and simple plan is to use a penny gum bottle. The sides will, most likely, be quite parallel, but rough. In order to smooth them, three sides may be rubbed on a wet stone, or a file will do. These sides, although scratched, will not be seen, but the fourth side or face will, so must not be interfered with. Perhaps the bottle will be sufficiently smooth to dispense with this process.

Now make four brass clamps shaped like the letter **Z**, but the angles to be right angles. They are fitted as in Fig. 9; *a* is the bottle, *b*, *c*, two of the clamps, screwed about  $\frac{1}{4}$  inch from the bottom, one on each side, same at the top. The rubbing on the stone will have removed any inequalities, and if the clamps are made nicely the bottle will move smoothly and evenly up and down, as the fourth side or surface, *d*, will perhaps not require smoothing. If it should, it is only done at the edges where the clamps go, in order that the movement should be easier. The surface is left untouched, as this will be exposed to sight, the zero point requiring, of necessity, to be seen. The smoothing on the top side can be done with a fine file, which will make an exact line with the breadth of the clamps at *d*.

As a gum bottle will be found to have a rather narrow neck, it would be better get a bottle with a wider opening, which can have a wooden plug, or large cork fitted to it, and in the usual way perforated for the tube and the zero point to pass through.

There are neat white bottles of finer glass than gum bottles made, which the reader can easily purchase. These will require no improvement, as they are very smooth and exact in their several proportions.

If a wooden cap is to be used, as described

in my article in last volume, space will have to be economised, so the feet of the clamps for the bottle are made  $\frac{1}{4}$  inch. If the clamps are bent in one piece they will occupy more space, and not be so exact in their fitting, owing to the rounded corners, as sharp angular clamps.

Fig. 9 represents a clamp made of three pieces soldered together and then filed smooth. They look nicer and fit the glass better, although more trouble to make than rounded corner clamps.

(To be continued.)

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## FITTING UP A WORKSHOP.

By REV. ALGERNON THOROLD.

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III.—JOINTING THE GROUND FRAME TOGETHER—PREPARING UPRIGHTS, CROSSBARS, RAFTERS, ETC.—PUTTING FRAMING TOGETHER—FLOORING—PAPER ROOFING—METHOD OF INCREASING AREA OF "LEAN-TO" BUILDING—FRAMEWORK OF FULL-SPAN BUILDING.

UR next work will be to prepare our scantling for erection. We first of all proceed to joint the ground framing together. This we may do in two ways, either by dovetailing the ends together, as in Fig. 5, or, which will be very much better, by halving them together, as in Fig. 6.

In passing, it may not be out of place to say that it is not, as a rule, a safe thing to depend upon dovetail joints in carpentry when the grain of the pieces of wood used are contrary to each other. If you put wood aside for a time and give it the opportunity of shrinking, it will be found, on being measured up again, that it has shrunk considerably more in its width than in its length. It is, consequently, easy to understand that, however firmly we may succeed in jointing heavy pieces together by this mode, in course of time the dovetail will certainly shrink away from its socket, and leave all the work to be done by any pin or bolt that may have been used as an assistance. Dovetails are, of course, frequently made use of in joinery, but it can only be considered a substantial joint, when, by the grain of both pieces running the same way, the contraction of one piece as it takes place is counterbalanced by the contraction of the other.

Acting, then, upon this well-founded law, we proceed to halve the four pieces of our ground frame together. We then put four screws in at each corner, leaving room between them to cut a square mortise straight through. This done, we take the uprights, *c*, *e*, *e*, and at one end of each cut what is termed a stub-tenon, really a foot which will fit square and tight into the mortises, already described and prepared.

In *c*, and in *e*, opposite to it, mark and cut out mortises to carry *L*; then take *L*, and cut tenons to correspond. Do the same to *e*, *e*, on the front to carry *F*, which also we treat as we have treated *L*.

Also, going higher, do the same, too, between the heads of *e* and *e*; *m*, *m*, *m*, *m*, and *k*, *k*, are, as before described, thin flat pieces upon which to stretch the paper covering; these we fasten into place by notching them into *L* and *B*, as deeply as the strips are thick (2 inches by 2½ inches), so that they may be flush with *L* and *B*, on the outside. We now come to the roof, *x* and *x*. The two extreme outside rafters must be fastened upon the heads, *c* and *e*, with ordinary tenons and mortises, bring them flush down to the edges respectively, having first of all bevelled the whole length of *o*, *o*, the front top or head of the frame, to the angle at which the roof will lie. All the other rafters should be notched in between these.

When all the fitting is satisfactorily finished we may proceed to put this plain framing together; the ground frame must first be fixed, and to do this properly we must dig out a small trench where the shop will stand, to a depth of about 8 inches.

This we fill in with ashes to about 6 inches, having first beaten the sub-soil as hard as we can with a rammer. Upon the top of these ashes, when levelled, we place a layer of bricks crossways, and, again, on their surface lay our ground frame. We shall now be well above the level of the earth, and need not be in fear of the dampness of the soil rotting the foundation of our shop.

This done, we then take our uprights, *c*, *d*, and *e*, and drop their feet into the mortises cut below in the frame; these must be nailed firmly

to the wall. To do this effectually, we first mark the places where the nails will fall, and, then, once more removing the uprights, cut out holes in the wall and plug them tightly with wood, then, having replaced the uprights, we fix them where they are to stand. *L*, *F*, *o*, *H*, may then be placed in position and finally fixed. After this, the back frame, Fig. 2, must be screwed up against the back of *c*, *d*, and *e*; the rafters, *x*, *x*, following in order into their respective positions.

After this, the intermediate slips, *m*, *m*, *k*, *k*, are nailed into place. If we look again at Fig. 4, which shows the whole shop in skeleton, we shall notice a frame in the roof, *R*, *R*, about which nothing has been said at present. This is the bed or support for the lights or windows, which we must have in the roof to give us a top light. It is merely a light framing sunk level into the rafters, and upon it, presently, we shall screw the lights, Fig. 2, outside. Having proceeded so far, another question will present itself. Of what shall we make our floor? Shall it be beaten earth and clay? or, shall it be a wooden floor, or shall it be bricks? There can be but little doubt which will prove the most satisfactory in the long run. Without a question, a wooden floor; the cost will not be great, and such as it is will be fully counterbalanced by the comfort.

The entire place will require very little more than a square of flooring (100 feet super), and all we want should not exceed 14s. in price. Let us decide upon having the place well-finished while we are about it, and add this quantity of flooring to our original estimate.

There are two methods, either of which we may employ in putting our floor down. We may either have it flush with the ground framing, or we may lay it upon the upper plate of the framing. If we place it upon the top of the frame, we shall find that it presents an awkward appearance at the door sill, and if we decide to have it flush with the frame, we must make arrangements for its reception before we put the ground framing together and fix it in its place. This we may either do by rebating the inner edge of the framing itself all



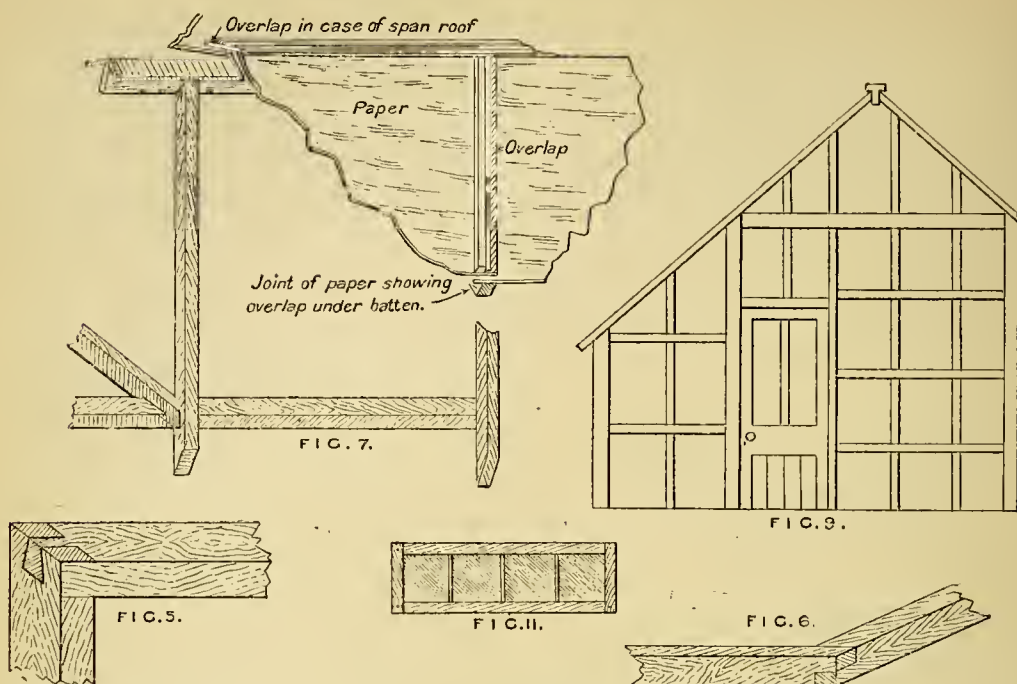


FIG. 5.—ENDS OF GROUND FRAMING DOVETAILED TOGETHER. FIG. 6.—ENDS OF GROUND FRAMING HALVED TOGETHER. FIG. 7.—METHOD OF LAYING PAPER ROOFING. FIG. 9.—METHOD OF SECURING ADDITIONAL AREA IN LEAN-TO SHOP. FIG. 11.—FRAMING FOR LIGHTS OR WINDOWS IN ROOF.

round to a width and depth of 1 inch, or, which will serve our purpose equally well, we may nail strips of wood upon the inside surface of the frame to form the rebate instead of cutting it. The latter plan is, of course, the only one open to us, if we have not made up our minds about our floor before fixing the framework in place.

A length of 12 feet will be too great for our floor without intermediate supports; it will be necessary, therefore, to insert two stretchers, Fig. 3 (dotted lines), in the ground framing. The floor will run lengthways. We may now proceed to nail our boards down, which being done, nothing remains but to cover in the framework with the prepared paper.

The paper covering which we are about to use

is a somewhat solid-looking substance, and not, perhaps, as our fancy may have pictured it, a mere flimsy thickness of even the best brown. The company which owns the patent for it is known as the Willesden Paper and Canvas Works Company, *Willesden Junction, Middlesex*, and the quality for our purpose is that known as the four-ply roofing. It is of different thicknesses, as may be surmised from the above designation, and it can be used according to its sub-

stance, either upon framework covered with boards, or upon the rafters direct, as in our own case. This paper roofing is made in rolls, 27 inches, and also 54 inches, wide; consequently the rafters should be spaced out 2 feet, or 2 feet 1½ inches, from centre to centre

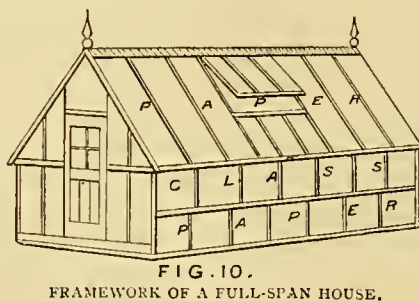


FIG. 10. FRAMEWORK OF A FULL-SPAN HOUSE.

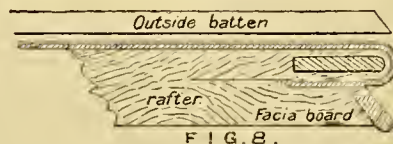


FIG. 8. PAPER ROOFING TURNED UNDER AT EAVES.

respectively. This arrangement enables us to lay our sheets so that the edge of one sheet laid vertically from eaves to ridge will overlap the edge of the adjoining sheet 3 inches at every joint, and there be fixed with outside battens on every rafter, as shown in Fig. 7. It is important to remember that in every case the wooden battens used should be  $2\frac{1}{4}$  inches by 1 inch, and that they should be nailed or screwed through batten and roofing to the rafter and framework below, thus ensuring good holding; the nails or screws used should not be less than  $2\frac{1}{2}$  inches to  $3\frac{1}{2}$  inches in length, and thus at every joint the overlap edges (3 inches, as above stated) of the adjoining sheets will be firmly gripped between the outside batten and the rafter.

Each sheet of roofing should be cut long enough to extend from eaves to ridge, allowing sufficient length not only to permit an overlap at the ridge but also enough for turning under at the eaves, there to be secured by fascia boards, see Fig. 8.

A certain amount of care is obviously needed in handling the paper, and it will be advisable in all cases, where a bend is required, as at the ridge or eaves, to place the part to be bent (not the whole sheet) in water for about a quarter of an hour.

Accidents will, however, happen at times, even to the most careful; should we, therefore, have a misfortune, a fracture may easily be repaired by simply sticking over the crack a strip of two-ply roofing, by means of a waterproof solution composed of two pounds of white lead to one pound of glue—in making this let the glue come to the boil, then add the white lead gradually and stir it well together. The paper is said to be waterproof; but we all know what an English winter is capable of doing on the most solid surfaces, so no harm can be done, the manufacturers say, by covering the roofing with a coat of good paint.

Now, of course, it is not to be supposed that the Paper House hereinbefore described will be as comfortable and warm as a more solid building, or even as a stable, which I have seen turned into a workshop; but, at least, the owner

will be in his own castle, and after a while, will, probably, make fresh discoveries for additional comforts.

A paper house will, there is no doubt, be a cool residence, but in summer time this will not appear as a detriment, and only when winter comes round will such a disadvantage make itself very evident.

It may sound venturesome to suggest a stove, but if due precautions are observed there is really no reason against its introduction.

These precautions will only consist of a slab of stone upon which to place the stove, and an iron plate to support the chimney as it passes through the side, and which should also be continued outside as high as the top of the house front, or wherever the chimney has its exit.

Before we leave this part of our paper it may be said that the plans already given of the lean-to shop may, without much trouble, be so altered, if desired, as to give a greater area to our building.

A glance at Fig. 9 may show how this is done. There we see the skeleton frame of the end of a half-span house, still making use of the side and end walls; but in case we require something larger still, in Fig. 10 we are shown the framework of a full-span house.

Probably, however, one of the two former plans will be adopted, since not only will much material be saved, but our shop will be much warmer by being built under two walls. As a matter of practical advice, for the small extra work and expense, the half-span is preferable to the lean-to, not only because it gives us more ground room, but greater height also. The lean-to house, however, is much simpler in its construction than either of the others, and will take less time in building. For these reasons the fuller description of that form of workshop has been given in this paper.

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**FLEXIBLE PAINT.**—The following retains sufficient flexibility to enable the sheet to be rolled:

Soft soap      ...      ...      2 ounces.

Boiling water      ...      ...      12 ounces.

Dissolve and work well into usual oil paint, 6 lb.—*Scientific American*.

## CLEANING AND RELACQUERING BRASSWORK.

By L. L.

N writing the following pages, it is not intended to attempt to teach the whole practice of brass finishing, but simply to afford sufficient information and instruction to my fellow-readers who may have occasion to do a little dipping and lacquering, either in the way of preserving the polish on articles of their own make, or in renovating articles that have become dirty and tarnished in use; and as most of the operations are really very simple, requiring more of that quality termed knack than any real technical skill, I think that the average workman or amateur will find little difficulty in making a decent job of anything he may undertake in this line, at any rate, I will try to make it as clear as I can. Many people have an idea that to relacquer old and dirty brasswork they have simply to buy a little lacquer, and apply with a brush, and, lo! the article assumes its pristine beauty. This, as will presently be shown, is a great mistake; several tedious and not over-clean processes having to be gone through before the article can be called relacquered.

The tools and materials required are as follows: Flat and half-round smooth and dead smooth files; emery cloth of various degrees of fineness; several burnishers of various shapes (see illustrations); aquafortis or nitric acid; lacquer and brushes. (N.B.—Nitric acid is a virulent poison and must be very carefully handled; the bottle containing it should be a stoppered one and labelled Poison, and a glass or gutta-percha funnel should be used to convey it back to the bottle after use. Care must, also, be taken not to get any of it on the clothes as it will burn holes in them.) A scrubbing brush will be required, also a dusting brush, some soda for making a lye to boil articles in to remove the old lacquer, a box of clean, dry sawdust, a couple of pails, a crock or some such utensil to contain the aquafortis whilst dipping, and a pair of copper tongs to hold the articles to be dipped—

iron ones will not do, as they will spoil the acid. To commence operations: the articles to be relacquered must (where practicable) if in several pieces, be taken apart for convenience in dipping, etc. They must then be boiled in strong soda water to remove the old lacquer, this must be thoroughly done, as the aquafortis will not touch it (the scrubbing brush will materially help in doing this); when this is done, rinse the articles in cold water and prepare for the next process, which is dipping. This had better be done in the open air, as the acid gives off fumes which attack and corrode almost everything. Pour into your crock about two or three pints of aquafortis; and I must here again caution the operator to use great care in handling this acid. Pour it out very gently holding it low down, so that it will not splash, for should a drop get in your eye it would be very painful; should such an accident occur, dash some milk in; it is as well to have a glass standing by, as should you swallow any of the fumes it will give relief to drink a little; wear an old apron or piece of sacking to protect the clothes. Place near the crock containing the acid, two pails of clean water.

Take the pieces to be dipped, one by one, and, with the copper tongs, rinse them quickly through the acid; each piece as it is brought out of the acid must be swilled round in one pail of water and then thrown into the other till all the pieces are done. Should the article not appear just the thing after rinsing it, give it another dip. Where there are a number of small articles, such as curtain rings, stair-rod eyes, links of chandelier chain, and such like, they may be more conveniently dipped by stringing them, several at a time, on a piece of copper or brass wire.

Having proceeded thus far, get a pail of very hot water and have your sawdust box and dusting brush ready to hand. Now take the articles from the pail of cold water in which they were left after dipping. Dip them once more, rinse in cold water, throw them into a pail of cold water, and when all are done throw them into the hot water, where let them remain a minute or two, then throw them into the



sawdust box and rub well to dry them, using dusting brush to clean out the crevices. When thoroughly clean, dry, and free from dust, wrap the pieces in tissue paper and put by for burnishing. Note.—This second dipping is done with fresh acid by the professional, but I hardly think it necessary for amateurs having, perhaps, only a few articles; I mention it, however, and the reader can please himself about doing it.

Before commencing to burnish, put away all the dipping utensils, washing them well to remove all traces of the acid. I may as well here mention that articles which are not suitable for dipping, such as cornice poles, tubes of chandeliers, etc., must be finished up by the smooth files, and emery cloth, the file must be held in both hands, the pole or tube fixed in the vice between a pair of lead clamps, and the file held at right angles to the pole or tube and drawn backwards and forwards—this is called draw-filing—it is then further smoothed by emery cloth wrapped round a piece of flat wood and drawn in the same way as the file.

For burnishing, several burnishers will be required. Figs. 1 to 6 show the shapes of some of the most useful; they can be bought at any good tool warehouse, or they can be made with very little difficulty, and as many persons (myself among the number) prefer to make their own tools, even at a little extra cost and trouble, I will try to describe the way to make these. Fig. 1, the long burnisher, is made as follows: Forge a piece of cast steel to the shape required, which is that of an ordinary steel, such as butchers use to whet their knives, in fact, I have made capital burnishers out of them, and if you can get a worn-out one it will save a lot of time in forging, but whether you forge it or use the old steel, it must be annealed by heating it to a cherry red and burying it in the ashes of the forge till cold. It must then be filed up with a coarse file, then draw-filed with a smooth file, then ground on a grindstone till it is fairly smooth—hold it lengthwise not crossways with the stone when grinding; the next thing is to harden and temper it; to do this, heat it evenly all over (except the shank) to a cherry red, dip in cold water, plunging it in

quite perpendicularly or it will warp; after this is done it must be handled very carefully as it will now be as brittle as glass, or nearly so. Grind it bright again, and temper it by heating a bar of iron red-hot and laying the burnisher on it, turning it so as to heat every part equally, when it gets to a full straw colour, then dip in cold water; it will still be rather brittle, and must not be dropped or handled roughly.

It must now be polished. This is done by rubbing on an oilstone till it is perfectly smooth and every scratch got out, then rub it well on a piece of hard wood with flour emery and oil, then with crocus and oil, and, lastly, with dry rottenstone on a piece of buff leather, when it should be as bright as silver. This burnisher is mostly used for tubes, rods, beading, and so forth.

Fig. 2 is the spear burnisher, it is used for flat surfaces, such as door plates, window bands, etc. The handle is about 2 feet long and is tucked under the arm, and the burnisher held by both hands near the ferrule, the long handle giving steadiness and control over it; this shape is also used much by pewterers, to burnish their pewter counters. The dimensions of this burnisher is as follows: tang, to drive in handle, 3 inches long, burnishing part 3 inches long,  $1\frac{3}{4}$  inches in widest part, full  $\frac{1}{8}$  of an inch in thickness; as only the edges are used for burnishing it need not be bright all over; one much smaller, of the same shape, is very useful.

The others are called relieving burnishers, and are used to burnish certain parts of the dipped articles, the bright polish given by them forming a contrast or relief to the dead surface given by dipping. They should be made out of  $\frac{1}{16}$  or  $\frac{3}{8}$  inch square steel, drawn down to about  $\frac{1}{8}$  inch in thickness at the ends; if used as lathe burnishers they must be left straight as I have sketched them, but for other work they must be bent at right angles at the dotted line, except Fig. 6, which is a knob. They must be filed into shape before being bent, then bent, polished, and tempered as before-mentioned. I suppose I need hardly say that only just the burnishing end is hardened, not all over, as the long one was.

For burnishing there will be wanted some

stale beer and water (about equal parts) in a jar, a piece of thick buff leather to rub the burnisher on occasionally whilst in use, a pair of lead clams to prevent the articles held in the vice from being damaged by the teeth; these clams are simply two pieces of thick sheet lead the width of the vice and 3 inches deep, grip them in the vice with about  $1\frac{1}{2}$  inches projecting from the jaws, double these back on each jaw, and rap down close with a mallet, and you have them; cover with brown paper as a further

satisfactory, press the burnisher firmly but not too hard, and when you have finished each part or section of the piece you are doing if it is a largish piece rub it gently with a piece of tissue paper to polish it. It should then have a nice bright polish without any streaks, if not, it must be done over again. Some of the larger pieces will require the beer applied with a small brush, but care must be taken not to let it run all over the work or it will dry on and cause you trouble. As each piece is done polish with a chamois

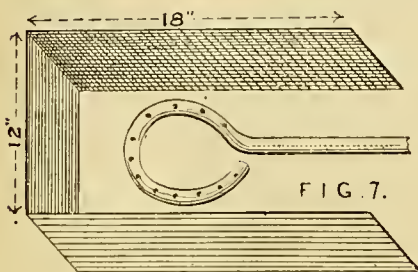


Fig. 1 Long Burnisher.

Fig. 2 Spear Burnisher.

Figs. 3, 4, 5, 6. Relieving Burnishers.

Fig. 7. Iron frame & ring-burner for lacquering.

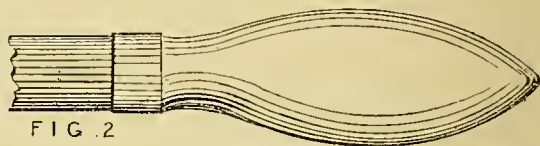


FIG. 2

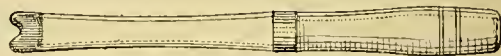


FIG. 3.



FIG. 4.



FIG. 5.

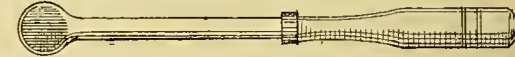


FIG. 6.

protection to the work. Of course, all pieces cannot be held in the vice. Now take up one of the pieces to be burnished, look well at it, and decide what parts are to be relieved. If it is a piece with leaves or flowers, the veining and stems of the leaves, and the petals of the flowers will be the parts to burnish, a grape pattern cornice pole end would have the grapes burnished, and so on. This is the part where the skill and taste comes in, some workmen making a much better job of it than others, according as the artistic faculty is developed; notice the way that good new work is done, this will help you a lot.

Having decided on your course of action, dip the end of the burnisher in the beer and water and commence rubbing the part to be relieved, just moving the burnisher in short strokes and taking care not to let it slip on to the surrounding parts, or the result will be anything but

leather, and wrap up in the tissue paper that it was taken from. The burnishers must be frequently rubbed on the leather or they will not give a good polish to the work. Having burnished all the pieces properly, take a pail of water and make it slightly acid by adding about 30 or 40 drops of aquafortis, have some boiling hot water ready also, rinse the articles in the acid water, then rinse for a few seconds in the hot water, and dry off again in the sawdust, carefully brush all the dust out of all crevices, and wrap up again till you have got all in readiness for lacquering.

For this process you will require a kind of stove or oven to heat the articles. What I have is a very simple arrangement; it consists of a

piece of sheet iron, 3 inches wide and 4 feet long, bent like Fig. 7, a ring burner is then to be made by taking a piece of  $\frac{1}{4}$  inch iron gas-pipe welding up one end and turning a ring 7 inches in diameter, and drilling some fine holes in it 2 inches apart, connect this to the nearest gas burner by a piece of flexible tube, a piece of sheet iron placed on the top of the frame for the brasswork to lay on, and the arrangement is complete. If no gas is available a piece of sheet iron placed over a paraffin stove answers very well, or, as a last resource, they might be placed on the top of your oven. A piece of brown paper must be laid over the articles when they are placed on the stove, to keep the heat in and to keep the dust off—dust is a foe to good work, so keep as free of it as possible.

You will want one or two tin pots for the lacquer, and some camel-hair brushes, flat and round, the flat for the plain surfaces, the round for small work. The tin pots may be  $1\frac{1}{2}$  inches deep, 2 inches over, and should have a wire bar soldered across to draw the brushes on. If you have many pieces, only put a few on the stove at a time, and as one piece is done put another on. To hold the pieces, you will want to use flat and round-nosed pliers and some pieces of stick, as many things can be held by a piece of stick thrust in a hole or crevice; the lacquer you can get pale or deep gold, according to the colour you wish the articles to be, they must not be got too hot but so that when the lacquer brush is applied to the work there is just a slight hissing noise, should it be too hot the lacquer will frizzle up and leave a brown stain on the article; it is better to lacquer a little short of the heat required and lay on the stove again to finish.

On the requisite heat being attained dip the brush in the lacquer, draw it across the wire to drain off superfluous lacquer, and go lightly and quickly over the piece, if not dark enough heat again and apply a second coat. Practice alone will render proficient in the matter, and the beginner must expect a few failures, but I think if these directions are carefully followed the failures will not be many. If there is anything that I have not made quite clear I will try to do so, if asked, in "Amateurs in Council."

## CONJURING APPARATUS : HOW TO MAKE AND HOW TO USE IT.

By D. ADAMSON.

### II.—TO PASS COINS THROUGH A TABLE.

**C**ONTINUING our financial operations in the conjuring line—we all know that there is a good deal of "juggling" with money, especially when it is handled in large amounts—another simple trick, and the necessary apparatus, will now be described. In the last one we saw how to pass a coin into a glass bottle, but that was child's play to this, for our task at present is to pass half-a-dozen pieces of money through the top of a table, or, for that matter, through anything else. Master Juvenile may think it easy enough to do so by boring a hole in the table top. This is certainly

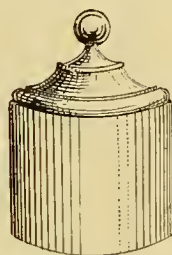


FIG. 1.  
COVER FOR COINS  
CONSTRUCTED OF BRASS  
TUBE WITH TURNED  
WOOD TOP.

one way out of the difficulty, but not ours. No, we want conjuring. Anyone can pass a half-penny through a hole, but to make several of them go through solid material without leaving any trace of their passage is quite an *autre chose*. "But do they really pass through the table," says one—his name is surely Thomas—who doubts everything he is told. Well, as "seeing is believing," just watch what takes place; but to make sure there is no trickery, examine the table carefully. It may have a hole through it somewhere, or springs, or something else, though to me, as conjurer, it is not of the slightest importance whether it has as many as a sieve, or none at all. Well, gentlemen, now that you are satisfied, kindly seat yourself on the other side of the table, or, if you prefer to do so, stand there. I am now about to engage in an ecclesiastical function, and I trust you will not object to its being at the beginning, instead of, as usual, at the end. I



ask you not to give liberally, but to lend freely, and only in halfpence. My friends, the collection will now be taken. The number of coins is not important. I am not greedy, but two or three of them would hardly display this experiment in a sufficiently interesting manner, while two or three dozen would make it rather a tedious one; eight or nine will do very well. There they are arranged in a heap, one on top of another, just like a miniature Eiffel Tower, only more solid. Please not to touch them, for the spell has begun. Slowly, so slowly as to be imperceptible, are they going; but, no matter, they will go quicker by-and-bye. They would sink through the table more quickly if the room were in the darkness of "blackest midnight born;" but, then, it might be said that they had been simply lifted up so, and transferred to the left hand underneath the table, like this. The darkness would be, to say the least, a suspicious element, but it is essential. It is, however, satisfactory to know that a sufficient degree can be got by merely covering the little column of halfpence as it now stands on the table. This little cap just fits over it, but no, it does not exclude all light. I remove the top halfpenny, but still the column is too high, so off goes another one or more, which the owners may as well have now — with thanks for the loan. Yes, just six left, that does nicely, and the cover must be left over them. Anyone like to see them, and be sure they have not been removed? Yes; well I raise the cap and replace it in such a way that there can be no doubt the coins are not removed. Of course, as they are covered, you can't see them, but if you are very quiet, you will hear them drop into my left hand, which you observe—or may do so if you like to look below the table, is just underneath the money. The coins will pass through singly. The first one will be inaudible, but you will hear the others falling on it when the signal has been given, by three distinct knocks on the table. One, two, three; there's the first one; now listen: one, two, three, four, five clinks of the halfpence falling on each other, and here, in my left hand, you see the half-dozen. Underneath the cap you see there is

nothing, not even the ghost of a halfpenny. Oh, yes, the cap may be examined, and the halfpence, too, without anyone being the wiser as to "how it is done."

The explanation is as follows: Six halfpence are prepared, to form either a solid column, or are connected by a piece of wire running through them. Each method has advantages and disadvantages. When soldered together there is no possible movement of the coins separately, as there is when hinged, as it were, together by a piece of wire running through them. The difficulty or risk of detection with the wire is, that as it is riveted at both ends, the slight flaw on the top coin might be recognized by anyone near enough and keen enough. On the whole, however, I prefer the method with the wire, and the risk can be quite overcome by passing and riveting through five halfpence only. The top one can then be soldered on. By this means only two of them are immovably stuck together. Now for a few more details. A piece of copper wire may be used, indeed, must be, if it goes through the six coins. Ordinary bell wire does very well. A hole must be drilled through each coin, so that when they are on the wire they lie evenly on each other. The hole should not pass through the exact centre of the coins, for, were it to do so, the effect would be just the same as if they were soldered together. A few slight taps on the ends of wire will rivet them securely enough. Now, with this wire sufficiently loose, it will be found that the halfpence can be put on the table in such a way that they appear quite disconnected with each other. They overhang each other here and there, so a little coaxing is necessary to bring them exactly on top of each other, and make a perfectly upright pile. This movability of the coins may seem a small matter, but, indirectly, it serves to impress on spectators, or confirm any who may be suspicious in the idea that the borrowed coins are those actually placed on the table. In other words, it gives a reality to the appearance of the pile just in the same way that the two or three which have been referred to as being removed during the performance of the trick do. These surplus coins are borrowed simply and

solely that they may be removed, for, taking them off one by one, the idea is conveyed that any of the remaining six might be treated in the same way. To remove them without some pretext would not do, and the one suggested will serve as well as any other. The cap is simply a little piece of tubing, sufficiently wide to go over the halfpence, that is, its internal diameter should be a trifle larger than a halfpenny. It must, also, be of a material thin enough to be slightly compressible without much effort, so that on raising it with a finger and thumb of the right hand, the pile of halfpence may be lifted at the same time. Ornamentation is not necessary, but may be indulged in to any extent, and I do not know that I can do better than describe one or two of the covers I have made at different times. Before going further, I should say that the height of the cover is not important, but that anything over  $1\frac{1}{2}$  inches would be quite unnecessary. It might be only enough to go over the pile, but I think it better to make them more. One cover is a piece of brass tubing, with a bit of wood turned to fit into the upper end by way of top. It is a little ornamental, as shown in Fig. 1. The knob on top is an opaque glass bead. A piece of wire passes through it and the cover. The bead, of course, turns round, and some people find a wonderful amount of satisfaction in twisting it while endeavouring to make out the mechanism (!) of the cover. They are convinced that the top has something to do with it, though they can't exactly see in what way. The hint should not be lost by the maker of a cover, for anything that tends to put spectators "off the scent" of the real way in which a trick is done should be taken advantage of.

Another cover is a bit of pasteboard tube, made by wrapping a few turns of glued paper round a piece of stick of the proper thickness, and stopping up the top with a disc of thick cardboard cut to fit it. A cover made in this way, and painted, looks "as right as ninepence," and will last a long time with care. Metal is, however, better.

As an extempore cover I have more than once used an ordinary visiting card of large

(lady's) size, by simply making it into a tube and gumming a piece of the waste margin from postage stamps down the seam. Perhaps such an improvised cover is the best of all because it looks so very simple, and can be made in the presence of those who watch the trick, thus disposing of the idea that there is any apparatus.

Very few remarks can now be necessary to enable any would-be conjurer to do the trick, which is an admirable one for private performance, though it is hardly big enough for the stage or platform.

Six of the borrowed halfpence are replaced by the prepared pile. This and the surplus ones are placed with the right hand on the table. The others are concealed in the left hand. While talking, there is generally plenty of opportunity of effecting the change, but in case none should occur before it is necessary to place them on the table, it will readily be perceived by the reader that the pretence of showing how the trick might be supposed to be done in a dark room affords an excellent opportunity of changing. In fact, there is no other reason for suggesting how it might be managed in the dark. The cover being on the six, the signal of three or any other number of raps may be given or omitted. It is only natural that one coin falling into an empty hand should make no sound. The second and other coins, however, fall on it, or, more correctly, are supposed to, and no difficulty will be experienced in making the five "chinks" in succession. The coins are then thrown on the table. With the right hand the cover and pile are lifted, and so inclined, that, on releasing the pressure, the latter falls into the palm. Simultaneously, or as nearly so as possible, the cover is dropped on the table. Spectators will give all their attention to it and the coins for at least sufficient time for the performer to drop the pile into one of his pockets—and the trick is done. But do not let him repeat it immediately, however much he may be urged to. Nothing is more common than for one's friends to ask him to "do it again," but neither this nor any other trick should be "done again." Another trick of a similar character may be shown, but to do the



same twice over is almost certain to destroy the conjurer's reputation for skill. Before giving a description of a trick which may well be done in connection with this one, a few remarks about variation of detail will not be amiss.

A commonly seen way of doing the trick just described is to have the coins hollowed out, all except the top one. The lower five, that is, are only the rims of halfpence. In the space a couple of small dice are placed, so that when the pile is lifted these are seen lying on the table. I do not like this form, for the simple reason that, if the coins are supposed to have passed through the table, it seems rather absurd to try and give the idea that they have likewise changed into dice. A somewhat similar form of the trick is when the halfpence are (apparently) changed into a threepenny-bit. If this latter coin be wanted for any trick it is a good way to get it, but in that case, the six loose halfpence should simply be put out of the way and no pretence be made that they have passed through the table. The threepenny-bit is, of course, "loaded" into a space inside the pile. Some care is necessary, if the pile is loaded, not to let the contents slip and appear too early when placing it on the table. Later on a description of a very easy but excellent trick, requiring no apparatus beyond a pocket handkerchief and a threepenny-bit, will be described, when the above method of getting the latter may be remembered with advantage.

#### PHOTOGRAPHING ON LINEN OR OTHER FABRIC.—

For decorating table napkins, bedroom trimmings, etc., the following simple process works satisfactorily, according to the *Photographic Review*: Boil the fabric in water containing a little soda, so as to remove the dressing, iron smooth and saturate with

Ammonium chloride, 2 gram. (about 31 grains)  
Water . . . . 250 c.c. (about 9 ounces)  
White of two eggs.

The above are well beaten together, allowed to subside, and strained. When dry, sensitize on the usual silver bath—rather a strong bath preferred—expose, tone, and fix as for an ordinary print on albumen paper.

## HOW TO MAKE A DINNER-WAGGON.

By ELECTRON.



DINNER-WAGGON is a very useful piece of furniture for a large or medium sized dining-room, and in a small room it will do duty for a sideboard if the lower portion be enclosed.

The accompanying drawing, Fig. 1, is a view of a dinner-waggon, made in oak and French polished, the lower portion being unenclosed; Figs. 2 and 3 are front and end views of the lower portion, when enclosed; the length is 3 feet 9 inches, and the breadth 1 foot 6 inches; the size can, of course, be varied to suit any particular recess. The two front pillars are 2 inches square, the top part turned, and a moulding worked on the lower part, as shown in Fig. 4. The back uprights are 2 inches by  $1\frac{1}{4}$  inches, the top rails are  $1\frac{1}{2}$  inches by 1 inch, the middle rails 2 inches by  $\frac{1}{2}$  inch, and the bottom rails 2 inches by 1 inch. Fig. 5 shows moulding on underside of top rails, and on top and bottom rails of cupboard doors.

The uprights and rails are mortised and glued, the tenons being accurately fitted. The top shelf is  $\frac{3}{4}$  inch thick, moulded on the edge, as shown in Fig. 6, a piece  $\frac{3}{4}$  inch by 2 inches being fixed round it underneath, moulded on the edge; the middle shelf and bottom shelf are  $\frac{1}{2}$  inch thick, rounded on the upper edge, and a bead worked on the lower edge; the corners are notched, so that they fit inside the rails, brackets are fixed under the lower rails to form feet, and castors are screwed to the brackets, to facilitate moving it about. The bottom shelf is  $6\frac{1}{2}$  inches above floor, the middle shelf 22 inches above this, and the top shelf  $19\frac{1}{2}$  inches above the middle shelf.

The rail at back of top shelf is 5 inches by 1 inch, with a bead worked on the top, and a moulding same as Fig. 4, worked down the centre; in this moulding, about 8 inches apart, circular moulded discs  $1\frac{1}{2}$  inches diameter are let in. Fig. 2 shows the lower portion enclosed, and formed into two drawers and two cupboards, in this case the bottom shelf, and the divisions between drawers and cupboards, are of pine, the



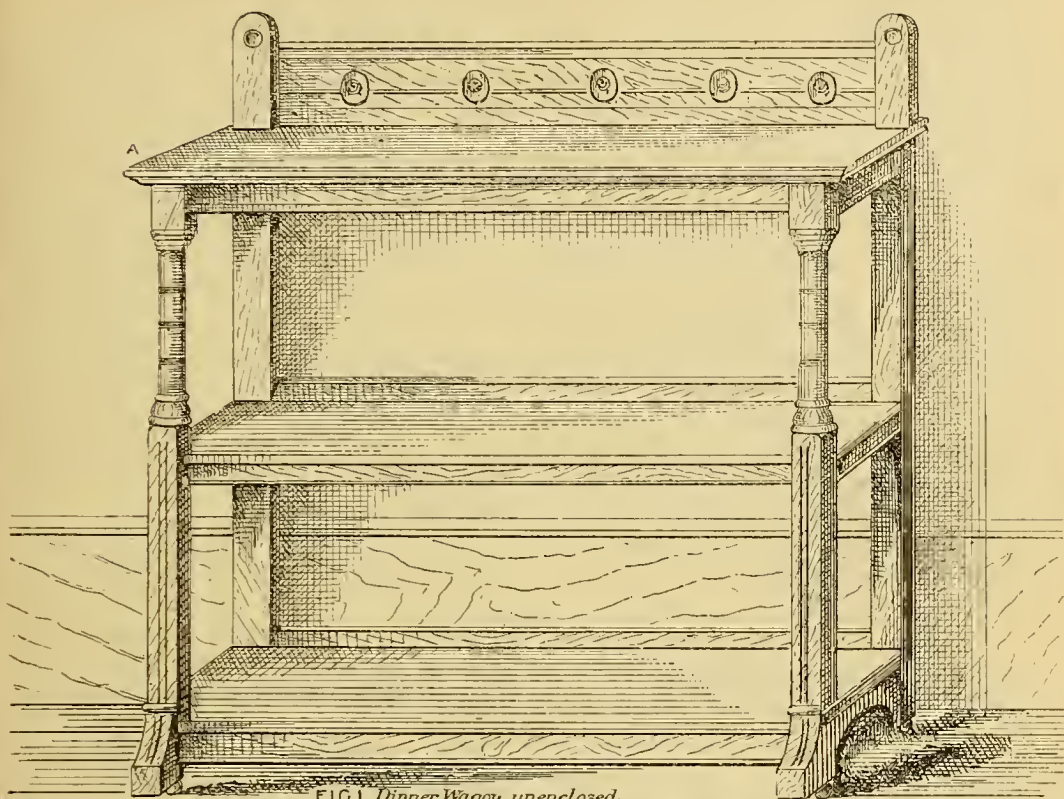


FIG. 1. Dinner Wagon unenclosed.



FIG. 4. Moulding at B fig 2.



FIG. 5. Moulding at C fig 2.



FIG. 6. Moulding on edge of top shelf.

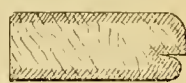


FIG. 7. Moulding on edge of middle shelf.

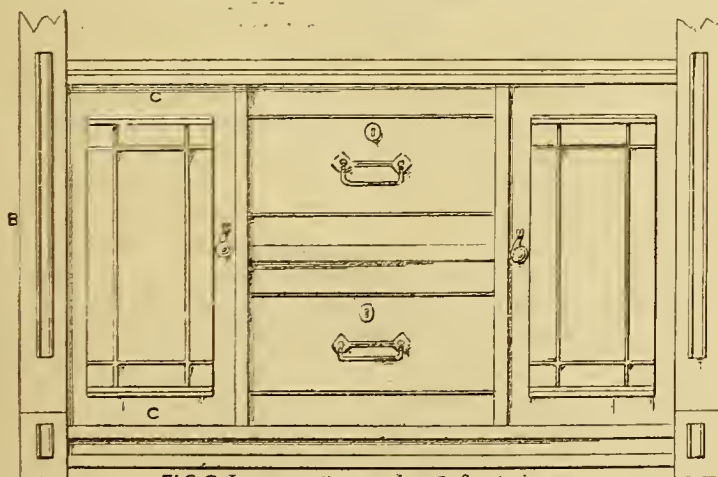


FIG. 2. Lower portion enclosed, front view.



FIG. 3. End view of fig 2.

divisions having a slip of oak glued on the front edge.

The drawer fronts are oak,  $\frac{3}{4}$  inch thick, with two beads worked on, the sides and back of drawers are  $\frac{1}{2}$  inch pine; the drawers are dovetailed together in the usual way, and the bottom let into grooves in the sides. The cupboard doors are 1 inch thick, the rails  $1\frac{1}{2}$  inches wide, the top and bottom rails are moulded on the edge, as shown in Fig. 5, the rails are mortised and glued at the joints, and a groove worked in the edge, into which the edges of the panels are fitted; the panels are  $\frac{1}{2}$  inch thick, with beads worked on, about 1 inch from the edge, these and the mouldings in centre of pillars are worked with a router, the outer end of cupboards are  $\frac{3}{4}$  inch oak with V joints tongued and grooved, the cupboard doors are hung with brass hinges, and the drawers and cupboards have brass cabinet handles and locks.

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## GALVANIC BATTERIES.

By ALLAN TRAYNOR.

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II.—THE NEGATIVE ELEMENT—CARBONS—CONSTANCY OF CURRENT—POROUS POTS—HOW TO TEST THEM—CONTAINING VESSELS—ELECTROMOTIVE FORCE—CONNECTING FOR INTENSITY—CONNECTING FOR QUANTITY—RESISTANCE—CURRENT—ELECTRICAL UNITS—PRACTICAL DETAILS OF CONSTRUCTION—THE SMEE CELL.



FOR the negative element the substance most generally used is carbon. Doubtless, the best carbon is that known as retort-scurf, the refuse of gas retorts. Its high quality for battery use arises from its being hard and dense. Its colour should be grey, and when struck, it should give a clear ring. The only difficulty connected with its use is the cutting of it to shape. To those who have strong arms and unwearied patience, the difficulty is not insurmountable. A bit of the blade of an old scythe, aided in its work with water and fine sand, will cut it.

The most generally used carbons, however, are artificial, and may be purchased in plate or block shape, as in Fig. 2, b, c. In the former,

a binding screw serves for connection; in the latter, a clamp, Fig. 2, d.

In all batteries, no matter how great or how small their output may be, the most desirable result is, that they shall be constant. Taking a battery that yields a current which is known, its constancy means that that current shall be maintained till its materials are worn out. We have noticed one cause of inconstancy—polarization—which reduces the current originally generated. Another cause is the formation of sulphate of zinc; that is, zinc dissolved by sulphuric acid. This gives rise to a fault which we shall notice later on; it increases the internal resistance of the battery. It may be safely said that a perfectly constant battery—a battery which shall yield a steady current under all conditions—does not exist.

The constancy of a battery is not to be confounded with its *duration*. Duration is a matter of materials, and depends upon there being sufficient to maintain the battery in action during the time its current is required. The size of the cell employed plays an important part in this respect.

*Porous Pots.*—All single-fluid cells may be said to be inconstant. The employment of two fluids reduces the fault to a very great extent. One fluid is employed in contact with the zinc element; the other is in contact with the carbon or other negative element, and absorbs the hydrogen, which would otherwise gather there. To prevent an over-rapid mingling of one fluid with the other, a porous pot is used as a partition between the two.

Porous pots may be obtained in any form or size, made of red or white clay. The red are the most porous, and are best suited for powerful currents of short duration. The white are hard and less porous, and are best suited for currents which have to be long sustained. In the Bunsen cell, for example, we should employ a red one; in the Daniell a white one. Before use, porous pots should always be tested by being filled with water. Should the water ooze through rapidly, the pot is unfit for use. Such a partition would cause a too rapid mingling of the liquids which it is meant to



keep apart, and the cell would soon fail. If no water appears on the outside of the pot in from ten to fifteen minutes, the pot is either too hard or too thick, and would thus offer too great a resistance to the passage of the current. Porous pots should neither be too hard nor too thick. The latter fault may be at once detected by examining the sides. Their thickness should not exceed  $\frac{3}{16}$ th of an inch.

It will be obvious that, besides having a porous pot, double-fluid cells have an outer or containing vessel. The outer cells, as a rule, are made of glazed earthenware, to resist the action of acids. Frequently they are also made of glass and vulcanite. In selecting vessels of glazed earthenware they should be carefully examined for any irregularities in the ware. Acid will find its way through earthenware, which, on a first look, gives no indications of unsoundness.

*Electromotive Force.*—The force which moves electricity from one place to another is called Electromotive Force, and may fitly be compared to *pressure*, as applied to the flow of water in a pipe. It is frequently written in the contracted form, E.M.F. This force depends entirely on the number of cells, and not on their size, nor the size of the plates. Suppose we have four cells, and connect the zinc and carbon plates, as in Fig. 3; that is, the carbon of the first cell is connected to the zinc of the second, the carbon of the second to the zinc in the third, and so on through the entire set, the carbon of the last being connected to the zinc of the first, the electromotive force of the battery will be four times as great as that of a single cell. When coupled up in this manner, a battery is said to be connected *in series*, and produces *intensity* of current.

If all the zincs are connected together, and all the carbons, as in Fig. 4, we get an entirely different result. The four cells no longer generate four times the E.M.F. of a single cell; they act as one large cell would act whose plates had four times the surface. That is to say, four times the quantity of electricity is generated, with the electromotive force of one large cell. When coupled up in this manner, a

battery is said to be connected in “parallel arc,” and produces, not intensity, as in the former case, but *quantity* of current.

When cells are connected in series, one important point should not be forgotten. The negative plates of all the cells should be the same size. The area of the negative surface determines the power of the battery. If the negative plate of one cell is of a smaller size than the rest, the force of the battery will be as though *all* the negative plates were the size of the smallest one, just as the strength of a chain is dependent on its weakest link.

In connecting cells in parallel arc, any difference in the size of plates or cells does not matter, but all the cells must be of the same kind and of equal E.M.F. Should there be a cell of weaker E.M.F. than its neighbours, the stronger will reverse the current of the weaker, less current will be got than if the weaker were off altogether, and the stronger cell will be exhausted sooner.

*Resistance.*—All substances—even conductors—resist the passage of electricity. The amount of resistance depends on the nature of the substance. It is usual to speak of two kinds of resistance, internal and external. The former is the resistance within the cell itself, caused by the plates and the liquid. The latter is the resistance which the current meets with outside the cell, as in the wire which conducts the current to its work, and the resistance of the work itself. To get the best results the internal and external resistances must be nearly equal.

*Current.*—Current and electromotive force are not to be considered as meaning the same thing. The first is in true proportion to the second, and also to the resistance which has to be overcome. The relationship which exists between the three important items, E.M.F., resistance, and current, must be distinctly kept in view. Current is proportional to E.M.F., and *inversely* proportional to resistance. Double the electromotive force and you will double the current; double the resistance and you will halve the current. Double the number of cells in series, and what happens? The E.M.F. only is doubled, and not the current, because the



resistance has been increased by the internal resistance of the cells which have been added.

How, then, are we to increase the current? Clearly, by reducing the internal resistance, which may be done in two ways:—1, The employment

of resistance is called the *ohm*, and is about equal to the resistance of 129 yards of copper wire  $\frac{1}{32}$  of an inch diameter. The unit of current is the *ampère*. The pressure of one volt, sending a current through a resistance of one ohm, produces

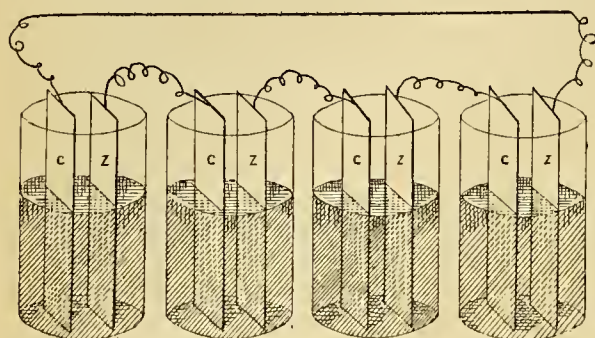


FIG. 3. Cells connected in series for intensity.

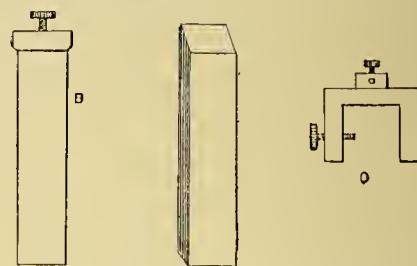


FIG. 2. B. Carbon plate . C. Carbon block, . D. Clamp for carbon block.

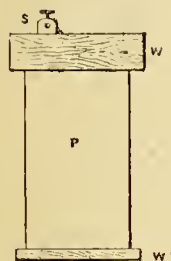


FIG. 5. Platinum foil fitted to wooden bar  
P Foil . W. Wooden bar.  
W'. Smaller bar.  
S Binding screw.

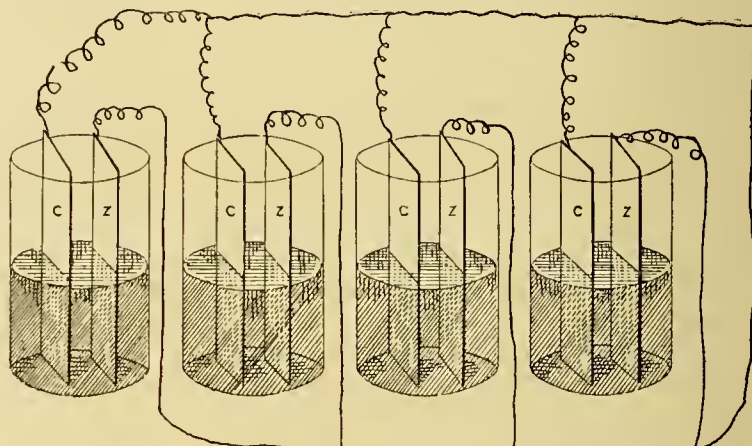


FIG. 4. Cells connected in parallel arc for quantity.

of battery plates of a larger size, placing them closer to each other in the cells; 2, joining up the cells in parallel arc, as in Fig. 4. The E.M.F. of these four cells is only equal to that of a single cell, but the current will be greater as their internal resistance is only one-fourth of that of a single cell.

**Electrical Units.**—Electromotive force, resistance, and current, have each a unit. The unit of E.M.F. is called the *volt*, and is about equal to the force of a Daniell cell. The unit

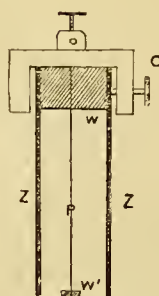


FIG. 6.—ARRANGEMENT OF ZINC PLATES, Z, Z, ALONGSIDE PLATINUM FOIL, P, W, W', WOODEN BARS; C, CLAMP.

a current of one ampère. The ampères vary directly with the E.M.F., and inversely with the resistance of the circuit. This is expressed by the well-known formula of Ohm's Law: strength of current in ampères equals the electromotive force in volts, divided by the resistance. Expressed by the usual symbols the law stands thus:— $C = \frac{E}{R}$ , where C is the symbol

of current in ampères; E, of electromotive force in volts; and R, of resistance in ohms.

There is another unit called the Coulomb. It is the unit of quantity, and is the measure of the amount of electricity given by one ampère of current in one second of time.

Practical details in the construction of some of the cells in every-day use will now be given, and the proper work for which each cell is suited pointed out. It is not the intention of the writer to notice every cell which inventors have seen fit to throw upon the market. If that were possible, it might result in the description of many that are useless. The law of the survival of the fittest holds good of a voltaic cell as of everything else. Only those whose "survival" has proved them to be the "fittest" shall be described. But before doing so, it may be as well, as we are about to handle acids, to give a hint as to how this may be done properly. All acids should be contained in glass-stoppered bottles and labelled. In making up acid solutions a graduated measure is absolutely necessary, and, perhaps, the handiest size is one that will measure up to 8 ounces. A solution is always said to contain so many parts of acid in so many parts of water, as, for example, 1 part acid in 10 parts water. This means that 1 ounce of acid is to be mixed with 10 ounces of water. The best way to proceed is to measure off the water *first* by means of the graduated dish, and pour it into a large wide-mouthed bottle. Then pour the quantity of acid required into the water, and stir with a glass rod. Label the bottle "1 sulphuric, 10 water." It may be mentioned that a basin of water should always be at hand when acid solutions are being made up. Should the fingers get burnt with acid plunge them into the water.

Beginning with cells of the single-fluid class, the first to be noticed is the

*Smee Cell*.—This cell consists of zinc for the positive, and platinized silver-foil for the negative, element. The exciting solution is 1 part of sulphuric acid in 10 parts of water. The containing vessel is a jar of glass, vulcanite, or earthenware, and may be either square or round. A suitable size, if square, is  $4\frac{1}{2}$  inches by 3 inches by  $1\frac{1}{2}$  inches; if round,  $5\frac{1}{2}$  inches by 3 inches. The glass beakers sold by scientific

instrument makers make cheap and effective containing vessels. The platinized silver-foil may be purchased ready for mounting in the battery. It is rough and of a dark colour. Many amateurs purchase the foil and platinize it themselves. The foil should be got as thin as possible. To platinize the foil it must first be cut to the desired size ( $4\frac{1}{2}$  inches long by  $2\frac{3}{4}$  inches broad will suit the size of cell now being described), then pour a small quantity of chloride of platinum solution into a shallow dish, lay the foil in the solution, and heat the liquid over a spirit lamp or a Bunsen burner.

The platinized silver-foil is now fitted into a solid bar of mahogany  $4\frac{1}{2}$  inches long and about  $\frac{3}{4}$  inch square. The wood must first be steeped for twenty minutes in melted paraffin wax, and, after it has been allowed to drain, a cut is made along its entire length with a fretsaw. Into this cut the foil is fixed. Should it be necessary to rivet the foil to the bar, pins of wood must be used. In all operations of this kind the platinized foil should be handled as little as possible, as there is the danger of rubbing off the platinum coat. Fig. 5 shows the foil fitted to the wooden bar. A second smaller bar of wood should be fitted, as described above, to the lower edge of the foil, as shown at w'. A long binding screw is fixed, as at s, so that the screw is in contact with the foil, to which it must be soldered. The joint should be carefully painted with a coat or two of good Brunswick black.

Two plates of amalgamated zinc are now required. The zinc plates in the Smee cell should always be slightly narrower than the foil, in order to allow for a free escape of gas. Plates 5 inches long by  $2\frac{1}{2}$  inches broad will be suitable in the present case. They are placed, one on each side of the foil, against the wooden bar, to which they are firmly held by means of a brass clamp. This clamp carries the binding screw for connection. Fig. 6 is a side view of the arrangement: z, z, are the plates of zinc facing the foil, p, which is fixed to the wooden bars, w, w'. When the cell is to be used the plates, as arranged, are placed inside the jar, which has been three-parts filled with exciting solution, as already described. The top bar of wood being

longer than the breadth of the jar, the projecting ends rest on its sides, and thus the plates are supported. On the cell being out of action, the plates should be lifted out of the solution and the water tap allowed to run on those parts which have been immersed. A few seconds will be enough to kill the adhering acid. The plates may then be laid aside.

Of single-fluid cells the Smee is one of the most constant. The surface of the platinized foil being composed of very minute points, the film of hydrogen gas which forms on it and would otherwise cause polarization, is readily given off. The cell is free from all unpleasant fumes. It may be used for working medical coils and electric bells. Its chief use, however, is in the electro-deposition of copper, silver, and gold.

(To be continued.)

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## PAPER HANGING.

By HENRY L. BENWELL.

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(Continued from page 366, Vol. I.)

### IV.—PANELLING—DADO AND FRIEZE—STAIRCASES.

**I**N previous chapters I have confined myself to the more simple methods of the paper-hanger's art, and I will now discourse lightly on staircases in general, panelling and frieze, filling and dado.

*Panelling.*—The panelling of rooms is now almost a gone-by taste, but there are some people with old-fashioned ideas who still persist in having their rooms treated in this way. I am not now taking into consideration the entrance halls and passages of public buildings, where a good deal of panel decoration of a high class still holds good. Such is beyond the domestic aspect of our subject. The easiest way, and the commonest, to panel a room, is to first completely cover the walls with the ground pattern, then measure and mark off the different panels, stiles, rails, etc. The stiles are now neatly cut out and laid on in a perfectly upright way. This sort of work may answer in a bedroom, or servant's hall, but will not answer at all for good paper and good rooms. We will

now proceed to panel, say, a drawing-room, in the orthodox and recognized fashion.

The room is first carefully measured and marked out on the bare walls into panels, stiles, etc., similar to the arrangement shown in Fig. 15, herewith. The lines may be struck with a chalk line, or ruled with a pencil and long straightedge, but they must be perfectly upright, and to ensure them being true in this respect, they must be frequently tested with the plumb line. The paper for the panels must now be cut out to the proper dimensions and laid on in the ordinary way. The border papers for the stiles and medallions, or other ornaments, are next trimmed, pasted, and affixed as usual.

*Dado, Filling and Frieze.*—Nothing, in our opinion, makes a room look more cosy and comfortable than a dado and frieze running round it. With the aid of a helpmate, we first of all run the chalk line round the room, as in Fig. 16. In doing this it all depends upon the pattern of the paper to be used, as to how many lines will be needed. In some papers the border above the dado is on the same piece as the dado, whilst in others it is separate, and sold at so much per yard. In the diagram, Fig. 16, we will take it that the border and the dado have to be used in separate parts, and draw our lines accordingly. In making our measurements we must make sure whether the skirting and ceiling are level or not, and, if not, the best arrangements possible under the circumstances must be resorted to, in order that the distance between frieze and dado shall be as near equal as possible all round the room. In very old houses it is sometimes found necessary to cut away a portion of the top of frieze, or some of the dado at bottom, in cases where the ceiling and floor are very bad. It is, however, impossible to lay down any stated rule for any case, as no two cases would probably be found alike. Having marked out the room, we now cut the "filling" to the proper lengths, paste, and lay on all round the room; when finished, next comes the frieze decoration at top, taking care that it is cut true, and that the bottom of it exactly meets the top of "filling," not allowing



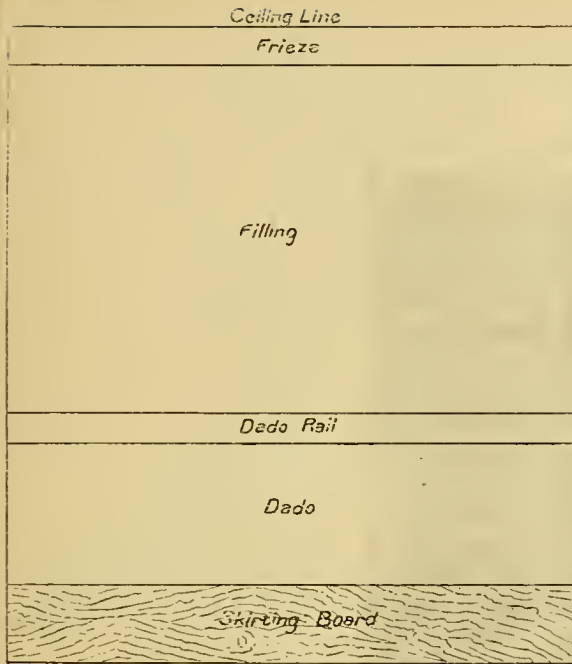


FIG. 16 Side of room outlined for papering

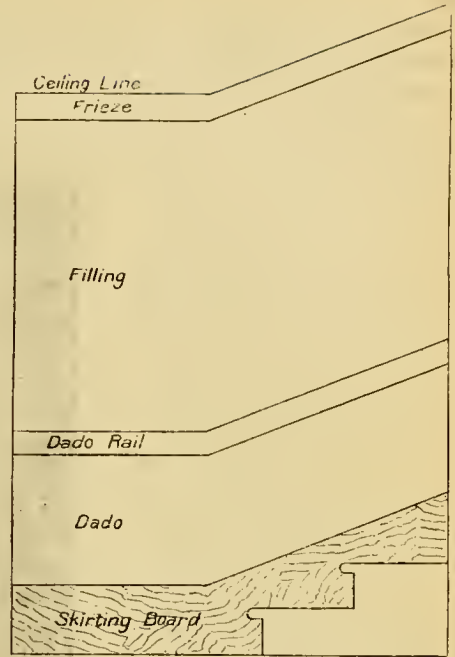


FIG. 18. Staircase outlined for papering.

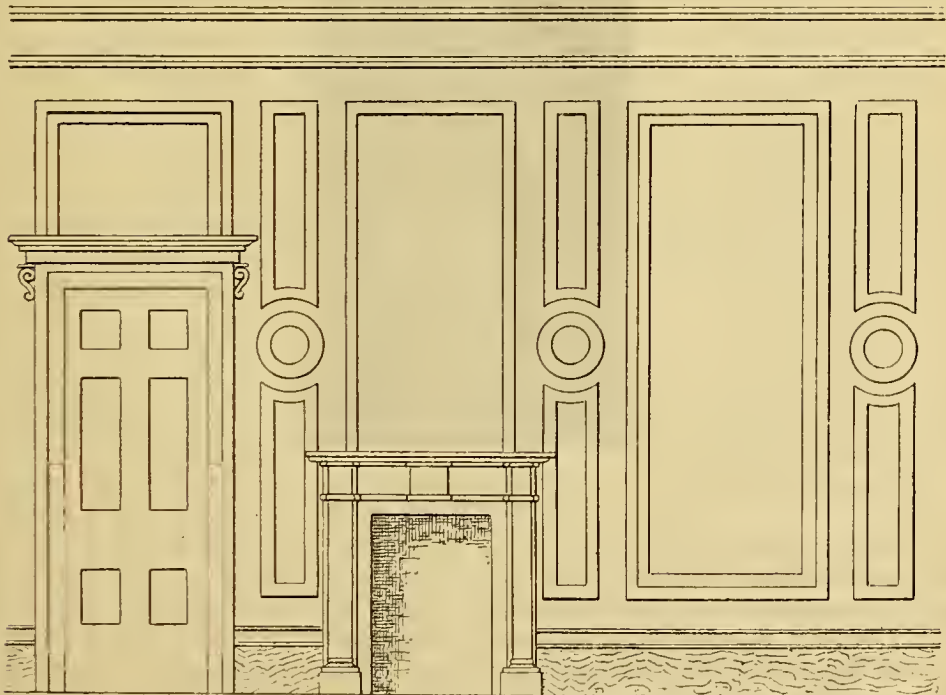


FIG. 15 Side of room outlined in panels ready for papering.

it to overlap in the least. I have forgotten to say that the height of the dado should be between 2 feet 2 inches and 2 feet 6 inches, never higher; this is without the border, and as this generally runs to 3 inches or 4 inches in width, we shall not be far off a yard when finished. A dado too low, or dwarfed, has a most puny and ridiculous appearance, and one too high has an ugly look; but I would certainly rather see one too high than too low, at any time. It is very easy, though, to hit the happy medium, and this in all cases should be done. We now affix the dado in short lengths all round the room, and finish off the job by running the dado borders along in suitable and workable lengths. Fig. 17 will give a good idea of the finished appearance.

*Staircases and Landings.*—We now come to rather a difficult part of the paper hanging art, *i.e.*, the papering of staircases, as when a dado is employed a lot of nice measuring and dodging has to be brought into play. One of the commonest styles of staircase decoration is that which consists of marbled paper, either divided into blocks or not, and varnished or unvarnished. A varnished paper of this description will withstand a lot of wear and tear, and will last for years.

Mr. Frank Rothwell, of *Jersey*, a clever decorator, and well-known authority on paper-hangings, in speaking of staircase decoration, says, "For ordinary wear and tear and artistic effect, a well-chosen dado decoration is, perhaps, the best. But if extreme durability is desired, it can be secured at the cost of art effect by

employing good marble papers, well hung in blocks, and lined out after hanging." Dados and marbles are now made to match good filling marbles. Marbles may also be hung in panels, providing a good contrast be secured for the stiles. Mr. Rothwell says, "it is best never to use lined marbles for staircase decoration. No staircase can be structurally lined or blocked out, unless unlined papers are employed." These can be lined out by the workman in due proportion, noting that whole blocks or stones should be carried right across doorways, windows, etc., just as a mason builds over openings with real marble. The joints of two blocks should never meet half-way over a door or window-frame.

The latest phrase of staircase decoration is that which is known as the "sanitary," or washable paper decoration. It need hardly be pointed out how much superior these papers are over the old order of things, as they may be washed with water and a soft cloth, without any fear of rubbing up the colours from the surface of the paper. In selecting these papers, I have always chosen a geometrical design in preference to the floral running patterns. In Fig. 18 is shown the method employed for marking or "laying out" staircase to re-

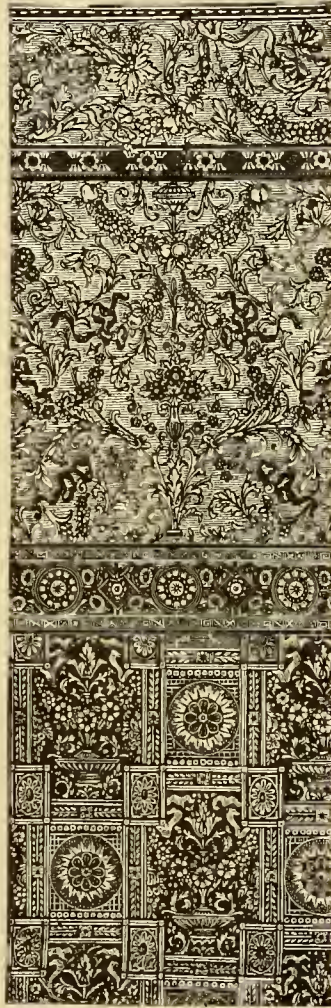


FIG. 17.—DINING-ROOM DADO AND FRIEZE DECORATION.

ceive this class of dado decoration. The following is a method of staircase decoration adopted by Mr. Rothwell a year or so ago, and looked, when finished, very effective and rich, yet in a subdued tone. "Some washable panel dados form the base; above that comes a carved wood, or wood and linerusta, dado rail,

and the filling is composed of plain colour washable grounds. These must be procured in the best quality made, or else they will hang shady. Above the filling a frieze, varying in width according to the height and character of the staircase, is fixed. The whole may then be sized and varnished in the usual manner." Such a decoration is as easily kept in repair as a painted wall, whilst the effect is better, and the cost less than a painted dado decoration.

(To be continued.)

## A HAT AND COAT RACK IN TURNED WORK.

By ALEXANDER MARTIN.



HERE is usually difficulty in finding accommodation in a narrow or small lobby for hats and coats. The general arrangement consists of a row of common

iron or brass hat-hooks, screwed to a belt of wood, which is fixed to hooks in the wall; but this has its drawbacks. The belting is sometimes placed so high up that it

is almost necessary to call a ladder into requisition when one wants to hang a hat up, and, to say the least, that is certainly inconvenient. But apart from the height of the belting, it never has—and, indeed, never *can* have—any pretension to beauty or to artistic merit. It is essentially a useful arrangement, and can never appear decorative, unless by the ornamentation of the brass hooks, and that is a very little detail in the matter at issue. This want of decorative power is perhaps the reason, at any rate, it is one reason, why so many hat racks are to be found throughout the country; they combine utility and beauty by holding garden cap or hard felt as well as the comfortable overcoat, and at the same

time, when not quite hidden altogether, forming a pleasant little feature of interest in what is perhaps otherwise a dull blank wall space.

The hat-rack illustrated herewith has, however, a peculiarity which most of these articles do not enjoy. It is entirely made up of turned work; there is not a square corner to be found in it, so that it is particularly well adapted for those who have a turning lathe and like to use it in some profitable way, while not caring to have much joinery work, in using their turnings to advantage. They may not be so accustomed to using the saw and the plane as the turning gouge, and they may not like them so well. Leisure hours ought to be spent in whatever direction affords most pleasure—at any rate, as regards the manufacture of articles for home use or otherwise; and this little hat-rack will suit admirably.

Another advantage this design may claim over others is the fact that there are no expensive

fittings required for which hard cash must be forthcoming. The only requisite is a pair of rings to screw into the top bar, to hold the article on the wall, and this will

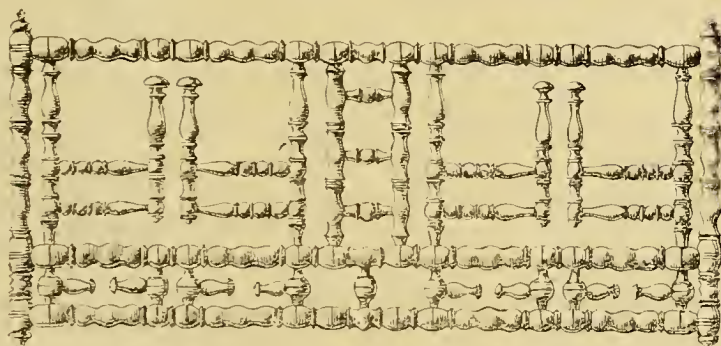


FIG. 4

not be grudged by anyone when the rack is finished.

The wood to be employed should be oak or mahogany; if the latter, get it as straight-grained as possible, because cross-grained wood would be so ready to split away. Then you do not need to pay any attention to the figure of the wood, as the turning is designed to be sufficiently decorative in itself. If cheapness be an object, birch would do nicely, and it could afterwards be stained to imitate any particular wood.

The drawing (Fig. 1) is so plain that it is almost self-explanatory. It is drawn exactly *one-half full size*; the little parts shown in Figs. 2 and 3 are drawn separately, simply because the





of the different pieces of wood required is given below, the sizes being, in all cases, the finished size of the various pieces at their thickest diameter, and the length being taken *over* the requisite pins, whether at one or both ends. The letters A to G are used on the drawing (Fig. 1) to designate them in the list following:—

| Piece. | Number of<br>pieces required. |     | Length.             | Diameter.            |
|--------|-------------------------------|-----|---------------------|----------------------|
| A ...  | 2                             | ... | $13\frac{1}{4}$ in. | $\frac{7}{8}$ inch.  |
| B ...  | 3                             | ... | $13\frac{1}{4}$ in. | $\frac{7}{8}$ inch.  |
| C ...  | 2                             | ... | $7\frac{3}{4}$ in.  | $\frac{7}{8}$ inch.  |
| D ...  | 2                             | ... | $6\frac{1}{2}$ in.  | $1\frac{1}{4}$ inch. |
| E ...  | 4                             | ... | $4\frac{3}{4}$ in.  | $\frac{5}{8}$ inch.  |
| F ...  | 4                             | ... | $2\frac{3}{8}$ in.  | $\frac{7}{8}$ inch.  |
| G ...  | 4                             | ... | $2\frac{1}{8}$ in.  | $\frac{3}{8}$ inch.  |

All the various pieces are fitted tightly and glued firm, except the pieces C and F. These are fitted tightly but *not* glued, so that they may turn freely on their pins. They also, it is true, might be glued fast, standing with their arms at right angles to the walls, but it is preferable to have them so that they can be folded flat against the wall when not in use.

If anyone wishes more accommodation than is shown in this article, with two hat-hooks and four coat-hooks, he can make two of them. If he would like them made all in one piece, Fig. 4 will show him the best way to go about it. Make it 2 feet 6 inches long, and all the other sizes as before. There will, then, be an open space left in the centre, which may be suitably filled up with other spindles, as shown in Fig. 4.

One word in closing is this—there may seem to be a lot of time in the many members shown in this design. That is true; the design might be made with fewer beads and hollows, and serve its purpose as a hat-rack equally well. But when a turner is making such a thing for his own home, or as a present, perhaps, to some friend who is “taking unto himself a wife,” he will be wise in spending some extra time over the work, and will certainly never regret it in after years.

I do not think that anyone reading this paper will require further instructions in what is, after all, a very simple matter, but, if necessary, I shall be pleased to render assistance.

## THE AMATEUR DEMONSTRATOR.

LIGHT (*continued*).

By OLIVER BECKERLEGGE.

### III.—REFRACTION ILLUSTRATED BY EXPERIMENTS.



It will be readily grasped that by reflection objects become visible, but we must now see how refraction helps us. Without this property, no sooner would the sun sink below the west than we should be shrouded in darkness. The atmosphere is a substance of varying density, and, consequently, of varying refracting power. Supposing, for convenience of illustration, the atmosphere were in distinct strata of varying density, light entering from above would make a path composed of angles approaching more and more to the perpendicular, as in Fig. 13. But as, in fact, there is an infinite gradation in density, the path of the light is a curve, so that, long after the sun has disappeared, the light which enters the higher regions of the atmosphere is curved downwards to the earth, and we have a gradually deepening twilight.

Another illustration will be seen in a lens; we may take as a common type a double convex one. This we see is, in reality, a medium of varying resistance, it is a circular curved wedge. The light at the centre passes through without being bent, but all the rays outside the centre are bent more and more toward the perpendicular, and meet in a focus, Fig. 14.

In the lens we have an instrument which enables us to avail ourselves of this peculiar property of refraction, by which two very important points are gained; the first is, that we can gather the light reflected from an object into a smaller compass, and so increase its brilliancy; and, secondly, the object is viewed at a greater angle, which is equal to its being brought nearer to the eye, and, consequently, the image is magnified.

A fact in connection with the use of the lens is often a subject of perplexity with the amateur optician, that is, the inversion of the image; everyone will have observed this who has handled a lens.

A simple experiment, without the use of a

lens, will show how this must be so; and hereby hangs a tale. Benjamin West, when a boy, on one occasion, when ill, was confined in a darkened room; one day he was dreadfully alarmed by seeing spectres flitting across his room. It was a great mystery to all until the doctor came, when he discovered a knot-hole, through which a few rays of light strayed.

FIG. 13.

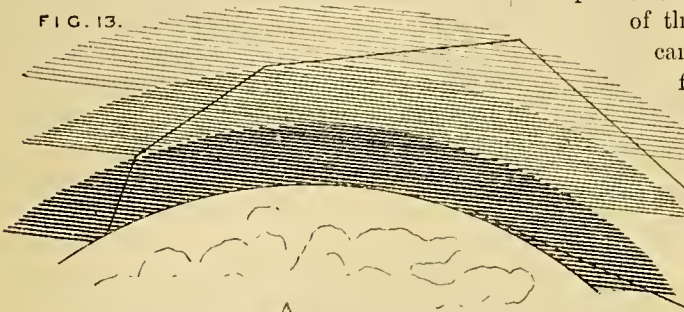
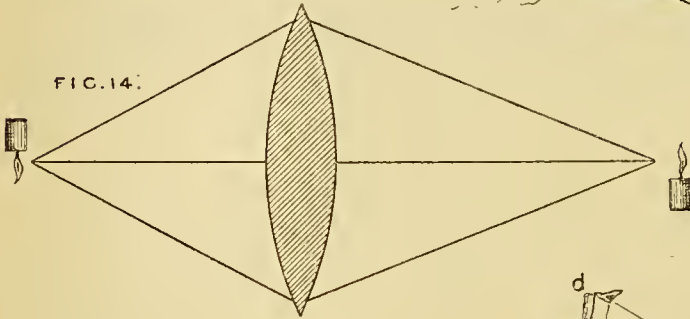


FIG. 14.



Whenever pigs or cows happened to cross the yard in a straight line with the knot hole, their image was projected in an inverted manner on the wall or ceiling of his room.

Take any common rough box, cut a hole in the bottom with a centre-bit, and cover it over with a piece of tin-plate, in which a pin hole is pierced. Now cover the top with ground glass or tissne paper. If the box is set on its end, and a candle is brought near to the hole, the image of the candle flame will be projected on the screen, but in an inverted position. If any object or figure is brought opposite the pin hole, and at the same time is strongly illuminated, the image will be cast on the screen, also inverted; this is really a camera obscura. Of necessity, if a large lens were used instead of a pin hole, more light would be grasped, and the

picture would be, consequently, more brilliant. Fig. 15 will make this clear; a is a screen with a pin hole; b is an object strongly illuminated. It is clear that if rays of light are projected in straight lines they must cross at the pin hole. Place the eye at c, when the object, c', will be perceived; raise the eye gradually, and each portion of the object will be seen until it reaches the point, d, when d' will be seen. If, instead of the eye, a screen is placed, as in our camera obscura, then the light reflected in straight lines from each point must present an inverted picture at c, d.

Another instructive experiment may be performed with an ordinary lens.

Take, say, an ordinary reading glass; now, if we hold it close

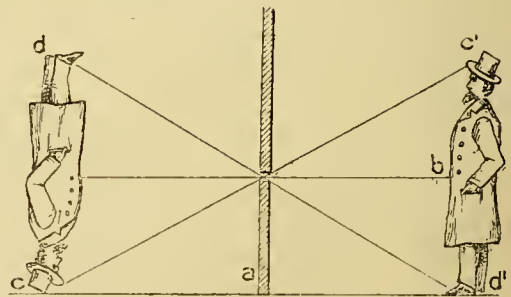


FIG. 15.

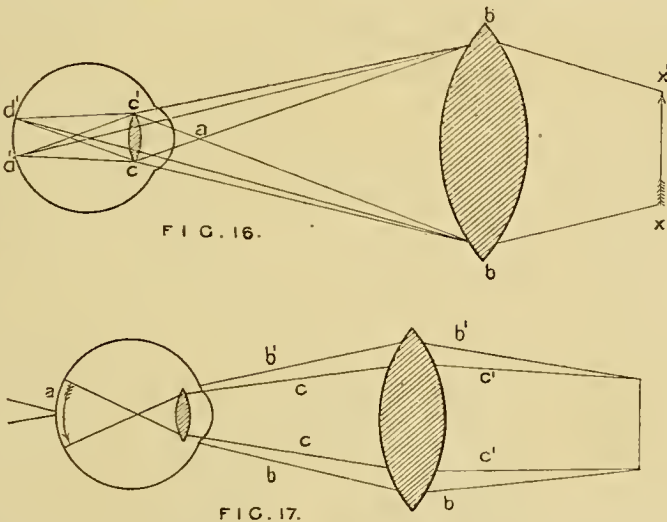
to the eye, we shall see the image enlarged, but not so distinct; remove it further away, the object becomes less and less distinct, until at last it becomes perfectly obliterated, when at once we see a beautifully illuminated picture, but inverted.

Figs. 16 and 17 will make this matter clear. In Fig. 16 we see the eye placed just behind the focal point, a. Consequently, the beam of light, x, after passing through the lens, b, b', is refracted to the point, a. The eye being placed



beyond this point receives the ray from *b*, at *c'*, and *b'*, at *c*, the lens of the eye again refracts the ray, when a picture is thrown on the retina at *d*, *d'*. Thus we see that the rays of light have crossed twice: once in front of the eye, and once in front of the retina. Now, it is generally known that upright images are received by the retina in an inverted position, but the brain in some way corrects the error. In this case we see in the diagram the image of the arrow erect, the result being that it will appear inverted, as we know from experience is the case.

In Fig. 17 the eye is brought forward in front of the focus, and before the rays have crossed; the consequence being that, as they only cross within the eye, the image is really inverted, but appears erect. This further will be seen, that the nearer the eye is brought to



the lens the larger will be the end of the cone of light, and all that part of the cone that is larger than the pupil of the eye will be cut off; hence, there is less light, and, consequently, a less brilliant picture than when the eye is placed beyond the focus, where it can grasp all the diverging rays. In Fig. 17 we see that the central portion of light between *c* and *c'* alone enters the eye, all the marginal rays, *b*, *b'*, are cut off; *a* is the focus of the lens.

**FILLER FOR LIGHT WOODS.**—Paraffin makes a good filler for light-coloured woods that are not required to have a hard finish. If a hard surface is required, use bleached shellac dissolved in pure alcohol. Fill, dry, and rub down with the finest sand-paper, and varnish with the white shellac made thin with alcohol or with white mastic varnish.

## FITTING AND ERECTING.

By A FOREMAN PATTERN-MAKER.

### XII.—HARDENING AND TEMPERING—SOLDERING.



**H**ARDENING and tempering are sometimes confounded through ignorance, and the terms are used as though synonymous, and so lead to error. By hardening, we mean the imparting to a substance the greatest degree of density of which it is capable. By tempering, we imply that a certain degree of density only is imparted thereto, according to

the purpose for which it is designed. The degrees of *temper* will accordingly vary for every distinct class of work.

In practice, hardening nearly always precedes tempering. The reason is that it is very difficult to raise a body to the precise grade of heat required

for tempering—much more difficult than it is to cool, or to “let it down” from a higher temperature to a lower.

Hardening and tempering are processes that put steel into a condition of unequal tension, hence the reason why so many precautions have to be taken to prevent warping and change of form from taking place. A long chapter might be written on the subject of devices which are, and have been, employed to diminish the evils incidental to change of form. The longer the article, the more likely is it to warp. Work which is thin and long will warp; work whose mass is unequally proportioned will warp. Among the devices employed are heating in boxes and cylinders to diffuse an equable temperature in the first place, plunging vertically into the hardening mixture, using lukewarm mixtures, cooling between plates of metal,

encasing in various substances, etc. The hardening and tempering of steel are delicate processes, which depend for their success entirely upon the skill of the workman, being derived from long practice, and cannot in any degree be taught from books. It is not sufficient to say that such and such colours are those at which steel should be quenched for any particular degree of temper required. As qualities of steel vary, so will shades of colour; and it requires a workman's practised eye to detect a given shade of colour correctly. A few examples in gradations of colour for tempering, gathered from a workman, are of far more value than the tables given in books. For this reason my remarks on this subject will be of a more general than particular character.

The less frequently steel is passed through the fire the better; the lower the temperature to which it is subjected, consistently with the results desired, the better. The fire should be clear, and for delicate work, charcoal is a better fuel than coal. Heavy works, and work having thick and thin portions in contiguity, are always liable to crack in hardening, owing to the unequal tension in the outer and inner layers. In forged works the scale should be always ground off before hardening, in order to lessen the tendency to distortion. Also, before "letting down," as the lowering of the temperature is termed, the thin film of oxide which forms in the fire should be removed by rubbing the surface with a stone, in order to render the changing shades of colour more visible. A cutting tool should properly be hardened, and tempered with a thick edge. If the edge is thin, then the temper of the thin edge will not be the same as that of the body of the tool. For this reason the behaviour of the edge of a cutting tool when first ground is no test of its subsequent behaviour. It may be better or worse, and the proper way to judge is to grind back  $\frac{1}{8}$  inch or  $\frac{1}{4}$  inch before forming an opinion. Small objects are often not put into the fire at all for tempering, but are heated on a hot bar of iron, the reason being that one can see better the gradual changes in the shades of colour when the eye has not been fatigued with the

glare of the fire. When tools are heated in the fire, they should properly be moved about or held in the central clear space, the aim thereby being to equalize the distribution of the heat as much as possible. In many cases, as where the body of a tool is large enough to afford a reservoir of heat, this is raised to a higher temperature than is required, and being removed from the fire, this then supplies heat to the cutting portion, raising its temperature to the colour required, at which stage the workman plunges the point into water. If the heat in the body is still in excess, and it is not desired to harden that, then the tool is kept out of the water until the point once more attains the colour for tempering. Then it is plunged in and re-tempered, by which time the shank will have become cooler, and may bear a total immersion without hardening it unduly. The hardening and tempering processes are frequently done at one heat in tools that have sufficient mass or body to retain their interior heat. Thus, a tool will be brought to a low red heat, and dipped instantly into water to harden it. Taking it out, the heat still remaining in the interior soon comes out to the surface, rendering the tool of a correct heat and colour for tempering, when it is finally thrust into water and moved about until quite cold.

Wearing surfaces in wrought iron are *case-hardened*, that is, a thin film of steel is formed on those surfaces. Link motion work, slide bars, and many other portions of machinery, are so treated.

Link motion and similar work is *case-hardened* as follows: A pot, called an annealing pot, made of cast iron, is used. It may be of almost any shape and size. Fig. 87 shows one common and convenient form, in section and plan. Into this is put the wrought iron work, enclosed entirely by carbonaceous and nitrogenous matter, as strips of old leather belting, bones, bone dust, hoofs, horns, or ferro-cyanide of potash. The whole is then hermetically sealed with a luting of wet fire-clay. Fresh bones and leather are more efficient and rapid in their action than old rotten leather and very stale bones. A little saltpetre or common salt added to the case-hardening mixture will assist

and intensify its action. The pot is then put into a furnace for a period varying from a dozen to thirty hours, according to the bulk of the work and the depth to which the case-hardening is required—about twenty-four hours of exposure to the temperature of a reverberatory furnace—not at a white heat, but a good full red will suffice to case-harden to a depth of about  $\frac{1}{16}$  inch, and this is sufficient for most work;  $\frac{1}{8}$  inch is sufficient depth for almost indefinite wear, and a deeper hardening tends in small fittings to weakness. When the case-hardening process has been continued sufficiently long, the contents of the pot are thrown out red hot into water. When quenched they may remain black, and be oiled simply, or they may be polished on the emery buff, or by hand.

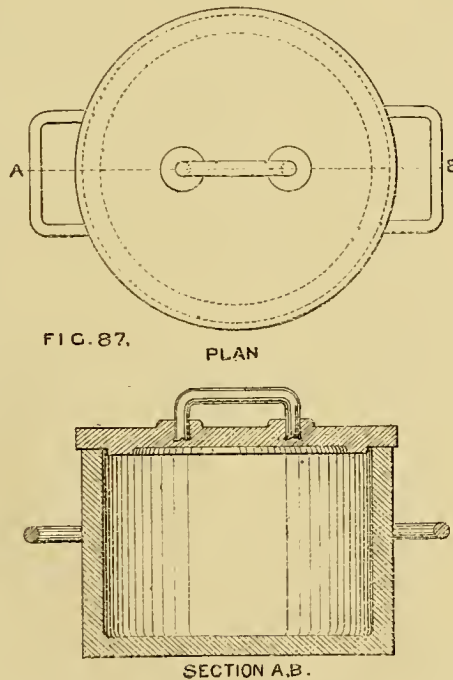
The pin holes will be found to have become very slightly smaller in consequence of the hardening process. Unless allowance has been made for this, they will have to be lapped out with an emery mandrel, before the pins will fit.

A knowledge of soldering and brazing is essential to the jobbing fitter, and is a desirable acquisition to any man. I will therefore devote the remainder of this article to a description of the methods by which these operations, which have much in common, are performed.

All solders are broadly divisible into the two principal classes of hard, and soft—union by means of the former is also denoted brazing. In the first class, a red heat is necessary for their fusion, in the second a comparatively low temperature, say of from 200° to 500° or 600° Fahr. The first are employed for the union of the bronzes, brasses, iron, copper; the second for tin,

lead, zinc, and alloys of those metals. Sometimes soft soldering is employed for the less fusible bronzes, etc., but this is exceptional. The general rule is that the solder to be used in any particular instance is only slightly less fusible than the metal or alloy which it unites. Then the work is of nearly equal strength throughout. But it is desirable that the melting point of the solder be slightly lower than that of the work, in order to prevent risk of fusion of the material at the time of soldering.

It appears as though the union of surfaces by soldering must be due to a slight fusion of the surfaces in contact, with the soldering agent. It is certain that no union will take place unless the surfaces are absolutely clean. Surfaces intended for soldering are scraped, or otherwise made bright, to ensure their union; and as bright surfaces very readily become oxidized, it is necessary to cover them with a film of some substance that has the property either of preventing the formation of such oxides, or of dissolving them as soon as formed. This is the whole mystery of the use



of resin, spirits of salts, borax, etc.:—they simply dissolve the oxide, and preserve the surfaces clean, so that the soldering material is able to make intimate and perfect contact with the opposed faces.

(To be continued.)

**SHELLAC VARNISH.**—Dissolve shellac in ninety-five per cent. alcohol to make the varnish of the proper consistency for the use required. For metals it should be very thin—for woodwork should be thin enough to spread easily with a camel-hair brush.



## A MIRROR BRACKET.

By SEMPER FIDELIS.

*(For Illustrations, see the Folding Sheet issued with this Part.)*

OME time ago my wife chanced to be at an auction, where she noticed a small looking-glass, which was a mean-looking little affair in a plain mahogany frame with a small brass ring to hang it up by, the glass of which turned out on further examination to be rather stout plate. The thought suddenly struck her that, having a handy man of a husband at home, it would be rather a good idea to buy the old glass and "give him directions" to make something pretty out of it—say, a bracket—anything, in fact; and if it was too much trouble, or was not feasible for any other reason, then there was no harm done, as it would make a capital shaving glass for the said handy man; and even this latter consummation was desirable, as it was sometimes very awkward to get near the dressing glass when he was shaving, and if one is hurrying to church, causes great misgivings as to whether the very top wire of the already heaped up trimming was just quite high enough on the hat.

Well, I set to work to make the affair, and we shall now proceed to see how it was made, and whether it justified the initial expense of one shilling and twopence. The glass itself measured 14 inches long by  $10\frac{1}{8}$  inches broad; it was very thick and good, and had to be used full size, as it was practically impossible for me to cut it with a diamond with any degree of certainty.

The first thing I did was to choose the sides and stiles of the bracket. I cut these from pine of 1 inch plank, full, and when the top stile and sides were squared and planed true, were exactly  $\frac{1}{2}$  inch square. The sides are 21 inches long each, and the top stile  $11\frac{5}{8}$  inches long, including  $\frac{3}{4}$  inch of tenon at each end. The bottom stile is deeper than the top one, being  $4\frac{1}{2}$  inches at the widest part, and 2 inches at the ends, and shaped as shown in the drawings, which are all drawn to a scale of one-fourth—that is, a quarter of an inch to an inch—with the excep-

tion of the perspective sketch. This said bottom stile was also cut from the same pine plank.

The first thing to be done when these are planed, squared, and shaped, is to put the sides into the lathe, and to turn the end knobs at the bottom on the solid end. I did this because I had been over this kind of work before, and found that unless the knobs were turned on the solid ends, they are a great nuisance, the slightest knock sufficing to bring them off.

I next proceeded to mortise the sides and tenon the stiles. This is considered by most amateurs to be a very heavy and troublesome job; let me assure any of that opinion that it is nothing of the sort, and only requires a little patience and correct setting out. To set out the marks for the joints get a double marking gauge and mark the lines, leaving the wood spaced into three equal divisions. Mark the places with this gauge from the front faces of the work, which must be distinguished in some way, so as to avoid errors; mark both tenon and mortise pieces with the same gauge. When you have the lines done for width of joint, then mark the length you intend it to be. In cutting from these marks, be careful to leave a tight joint. A good plan is to just leave the lines standing and trim the wood down with a sharp chisel. Old hands may think that these details are unnecessary. All I can say is, that I am not writing for them. These mortises do not go quite through the sides, but nearly so. When the joints are ultimately finished, a small sprig may be driven through the back to strengthen the joint, but it is not necessary. When the stiles and sides are ready, it is best to glue them up out of the way, and that may be done straight off.

The next thing after that is to get four strips of thin wood, and plane them down to  $\frac{1}{2}$  inch by  $\frac{1}{4}$  inch. These are to be rounded on the edge, and glued and tacked into the frame to form a rebate to hold the glass; these are to be mitred in the corners, and the sprigs used by shoemakers are as good as anything else to use in fixing them.

The shelves and supports are next to be made and fixed. The top shelf is square, and measures  $12\frac{1}{2}$  inches by 6 inches wide, of  $\frac{1}{2}$  inch

stuff. The bottom shelf is a segment of a circle,  $12\frac{1}{8}$  inches long by 5 inches at the widest part. The supports of the top shelf are of  $\frac{1}{2}$  inch wood  $3\frac{3}{4}$  inches by  $2\frac{1}{2}$  inches; the support for the bottom shelf is 4 inches long by  $2\frac{1}{2}$  inches wide, shaped as in drawings.

The next thing now is the turned railing hanging from the top shelf. The two outer turned ends are  $\frac{3}{4}$  inch square, with the knob turned on the solid (full size drawing of these). The rails are  $1\frac{1}{8}$  inches long, turned out of  $\frac{1}{2}$  inch wood. A small lug must be turned and left on each end of the rails in addition to the  $1\frac{1}{8}$  inch of length, and corresponding holes are to be bored in the underside of the top shelf to fix the rails to by the lugs, and also in the cross bar which carries the lower ends of the rails. This bar may be  $\frac{3}{8}$  inch stuff  $\frac{3}{4}$  inch wide. A drop of glue is to be dropped into the holes when fixing up, and on the ends of the outer rails, which, with a sprig driven from the top of the shelf downwards, will be sufficient to keep them in place.

After the shelves and railing are fixed, put in the glass and back, which may be of very thin boarding; and between the glass and back put a sheet or two of clean blotting-paper. When finally fixing the back, which may be done with the shoemakers' sprigs, drive them well home, and be careful when driving them not to shift the back and thereby scratch the mercury off the glass. The manner of fixing mirror glass into frames is to leave a slight space all round and to fill up that space by a wedge-shaped piece of wood, so fixed that the glass is wedged into place and tacked to the frame in position, keeping the glass from moving. The thin wood back is then put on, the outside being tacked to the face of the work. I mention this, as, perhaps, some reader may have seen these wedges and be able to do them; but to anyone not knowing them, the simpler plan first mentioned is the best. Nothing remains now but to give the bracket three thin coats of enamel paint—say, ivory, with gold balls and railings. The result is good, and I venture to say that anyone making these brackets will find them satisfactory.

## NOTES ON NOVELTIES.

By THE EDITOR.

7. COLLOTYPE AND PHOTO-LITHOGRAPHY. 8. WATKINS' PATENT RESINOUS SOLDERING FLUX.

7. OLLOTYPE and PHOTO-LITHOGRAPHY. Published by Kiffe and Son, 3, St. Bride Street, London, E.C. I have recently had so many inquiries respecting photo-lithography, that I am glad to have an opportunity of recommending so excellent a work as the one before me. The author, Edwin C. Middleton, states in his preface that it is a free translation of the German work of Dr. Schnauss, with considerable extensions made by himself. It forms a most complete guide to the production of pictures by photo-lithography, and goes so fully into every detail that an amateur, after a few trials, may produce excellent work by carefully following the instructions given in its pages. A very fine specimen of this class of printing is given as a frontispiece, of which the author says: "Without pointing to the frontispiece in any sense as a high-class work, it may serve to show that I have made some practical acquaintance with the subject. The illustration, printed on ordinary paper, was produced from the instructions found in this work, and I may add that at the time of writing I have printed over 500 impressions from the first plate, and it still remains in fair working condition." The book (published at 5s.) is well printed on good paper, and should be in the hands of all who are interested in photography.

8. *Watkins' Patent Resinous Soldering Flux.*—Mr. Watkins, 29, Alma Street, Eccles, writes:—"Knowing the interest you take in all improvements and inventions, and especially those for the benefit of amateur workers, I take the liberty of sending you a sample of a Patent Soldering Flux which I have invented. The ordinary fluxes at present in use, viz., Spirits of Salts and Baker's Fluid, possess well-known disadvantages that render them unfit for use for all electrical work and also for use in culinary articles. Powdered resin is inconvenient and difficult to use as compared with a liquid, as it lies only on the surface of the work and will not run properly into the joints. My Patent Resinous Soldering Flux, consisting solely of resin dissolved in a volatile solvent, which has no corroding effect on any metal, overcomes all these disadvantages, and being in a liquid form, easily permeates a joint, and on the application of heat (from the soldering-iron) leaves a coating of pure resin on the whole joint to which it has been applied. For all electrical work, tinsmith's and plumber's work, it will be found invaluable, as it is convenient, effective, economical, and leaves no stain or after effect. I enclose you a joint made with bare copper cable, to show how easily and thoroughly the solder runs. I shall be pleased to forward samples to any of your readers who may desire to try the flux for themselves, on receipt of stamps (two) to cover postage." I have given the flux a fair trial, and have very much pleasure in endorsing all that the inventor says of it. Its use makes soldering a simple and easy matter, and, by using the flux, I was enabled to make some difficult joints which I failed to make when using powdered resin alone. I would strongly advise my readers to send for a sample. Mr. Watkins omits to state the price of the soldering fluid.



## AMATEURS IN COUNCIL.

For "Instructions to Contributors and Correspondents," see page 46 of this Volume, or Part 13 (New Series), p. 46.

### "Annexed" 1

AN American paper, *Carpentry and Building*, has been so struck with admiration for Mr. Alexander Martin's design for "A Small Cabinet," issued as a Supplement with the July Part of the last volume of *AMATEUR WORK*, that it has transferred the said design, and also the accompanying letterpress, to a prominent position in its own pages. Unfortunately, in the excess of its enthusiasm, it has quite forgotten to acknowledge the source whence the article in question was taken, so that the readers of *Carpentry and Building* who are not behind the scenes, will now have a better opinion of the contents of that paper than they have hitherto enjoyed. I believe the American term for this sort of thing is "anuxing": it sounds better than our expression.

### Ladies' Workbox with Drawer.

**NIGGER** (*Croydon*).—Your request for the above has been put in the hands of a competent man, who will write an article giving full detailed instructions for making such a box as you require.

### Thanks.

I BEG to thank **ELECTRON** for the information he has so kindly supplied me with through your valuable Magazine, and will follow the instructions accordingly.—**TOM WRIGHT**.

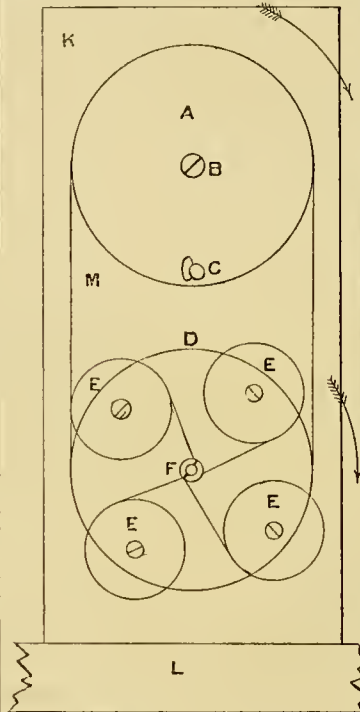
### Casting Lead in Wooden Moulds.

**CLERICUS SECUNDUS**.—The wood for the moulds should be thick: I have cast 10 pounds weight in wood, the mould being 2 inches thick. In casting a second time from the same mould, it should be quite cold before pouring: but you cannot get more than two or three from one mould, as the wood gets so dry and brittle that it breaks in getting the casting out, in which case a new one must be made. The lead should not be too hot; if a stick dipped into it takes fire or is charred very much it is too hot, and should be left till cooler. Wooden moulds are handy for any odd article, but for a quantity of one kind the mould should be of more durable material.—**ELECTRON**.

### Wire-Covering Machine.

**COTTON COVERED** writes:—"While looking over some back volumes of *AMATEUR WORK* I came across a description of a wire-covering machine.

This seems to me a very complicated machine for most amateurs to construct. The following is a description of a very simple arrangement for accomplishing the same object. The process of covering is rather slow, but quite fast enough for an ordinary amateur. K is an upright board fixed to a baseboard, L; A is a wheel of hard wood with a flange turned on it to receive the driving strap, M; B is a screw forming the axle of wheel, A; and C, is a handle to drive it with. D is another wheel of hard wood with flange. The axis of this



WIRE-COVERING MACHINE.

wheel is formed of a brass screw, F, having a hole drilled through it and through the board behind it. E, E, E, E, are reels of cotton or silk fixed on F, and turning with slight friction. The wire to be covered is pushed through F, the four threads are tied to the wire, the handle, C, turned in direction of arrow, and the wire pulled through F at the proper speed by hand. I may add that I am thoroughly satisfied with *AMATEUR WORK*, and have received some valuable hints from its pages. I consider it the best Magazine of its kind published."

### Portable Harmonium Building.

**MR. SANDERSON** writes:—"I must draw your attention to Fig. 23, A, in

Part 12 (Vol. 1., page 560). In my original sketch I have shown 20 slots cut in the beads and arranged in groups of two's and three's, whilst the illustration shows, I should think, over fifty. Perhaps, as the section is given correctly, another drawing will be unnecessary."

### A Whatnot Made of Cotton Reels.

**AMATEUR**.—In reply to the query sent by **AN AMATEUR**, I am sorry I made use of an expression which he could not understand, but I think the term I used, of having a piece of iron rod "shut in" a bolt, is one usually used by smiths. What I meant was, to procure three bolts of  $\frac{1}{4}$  in. thickness and about 4 or 6 inches long, have them cut through the middle, then cut three lengths of iron rod of the same thickness as the bolts, and of sufficient length to allow for welding, and weld the two ends of each bolt on to the ends of each rod respectively, taking care to get them all exact according to length. You then have the bolts the same as they were before, only elongated. If **AN AMATEUR**, or anyone else, should find any difficulty in getting the bolts made up, I shall be happy to forward a set ready for use, for 3s. I see that **AN AMATEUR** lives some distance from that famous place, or with regard to the expression "shut in" he might have "Larn't it in the school at Killaloe."—**MIKADO**.

### "Notes on Novelties."—A Suggestion.

**R. R.** writes:—"I take advantage of your permission to suggest that the price of books, etc., mentioned in 'Notes on Novelties,' should be stated. This would be a great advantage to country readers, more particularly those with slender means, who must know prices before purchasing." [It is not usual in reviewing books to mention the price, but if the information will be useful to my readers, *AMATEUR WORK* will form an exception to this rule, and if publishers who send me books for review will, in future, oblige me with this information, it shall be mentioned in the notice.—**ED.**]

### Drilling Machine Castings.

**W. F. PARRY DE WINTON**.—The drilling machine castings can be obtained from Mr. J. Reside, Engineer, *Rastrick, Brighouse, Yorks*; see also Part 11, page 532. The planing machine castings can be obtained from Mr. Thos. Taylor, *Chester Street, Hulme, Manchester*.—**ELECTRON**.

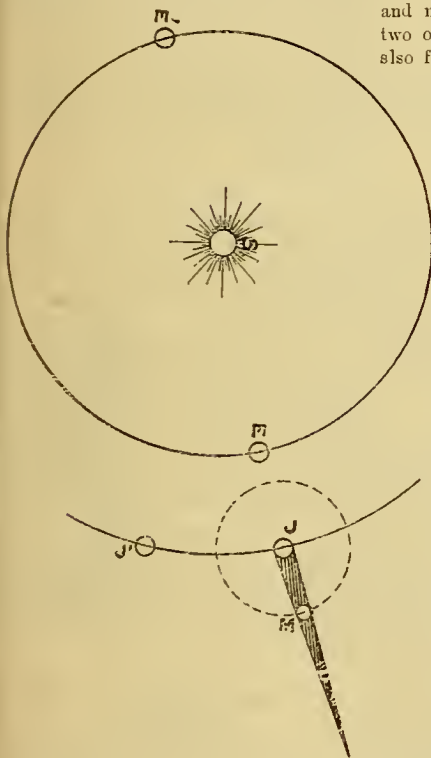


**Castings for Electro Motor.**

**ATROS.**—The castings of electro motor can be obtained from Mr. G. Bowron, Electrical Engineer, 97, Crawford Street, W.—**ELECTRON.**

**"The Demonstrator.—Light."**

**THE AUTHOR** writes:—"Through a misconception on the part of the engraver I fear that Fig. 2 on page 32 will much perplex the reader, as it does not throw any light on the text. The orbit of Jupiter should be concentric with the orbit of the Earth. When the Earth was at E, Jupiter was at J; in six



**THE DEMONSTRATOR.**

E, Earth; J, Jupiter; M, Moon.

months the Earth had travelled to E', but as Jupiter requires nearly twelve of our years to complete her revolution she had only travelled one twenty-fourth part of her journey and was at J', which practically left it much in the same place it occupied before; whilst the Earth had removed the whole diameter of its orbit. I think this note will make matters plain."—**O. B.**

**Paper Pipes.**

**T. M.**—Scale for Open Diapason CC, 5½ inches diameter; Tenor C, 2½ inches. You will find full instructions as to making these pipes, giving scales, etc., in the

First Part of Volume II. of **AMATEUR WORK** (Part 12).—**M. W.**

**American Organ Building.**

**H. SEWELL** (Nottingham).—Two inches should be allowed between each hole in Fig. 3a; and the end hole must be four inches from either end of the middle-board, or two and a half inches from each extremity of the part B.—**T. C. W.**

**H. W.** (Whitchurch).—I was interested to see the first paper on the above subject, and I hope there will be, later on, directions for building larger and more complete instruments, with two or three manuals and pedals, and also for adding manuals and pedals to existing organs. Two or three years ago I helped a friend to make a four-row American Organ, and I now venture to give the result of my experiences to intending builders. To save valuable space I will put my remarks in a summarized form:—1. Make the case and bellows as spacious as possible, with a view to enlarging the instrument from time to time. 2. If the instrument is intended for the performance of organ music (three staves), and to be without pedals, the compass should be extended downwards to 16 ft., C, the pedal part can then be played by a second performer exactly as written, which is impossible on the F compass. 3. Four rows of reeds (16 ft., 8 ft., 8 ft., 4 ft.), with treble and bass coupler both coupling up, are much more satisfactory, in point of balance of tone when all the stops are drawn, than three rows.

**Dimensions of Boiler.**

**LINELLE.**—I cannot understand from your rough sketch what class of boiler you want. It appears to be intended for a return tubular land boiler set in brickwork, or it may be a return tubular boiler of marine type. If you will say more precisely what class you require, I will give you a dimensioned working sketch of same.—**J. H.**

**Value of "Ours" to Colonists.**

**E. A. F.** writes:—"I have just returned from five years' stay, as missionary in East Central Africa, and I had there with me the two first Volumes of **AMATEUR WORK**—having begun to subscribe with first number, until time I left England. I found the said Vols. most useful, and got several ideas from them. Of course, I had to alter

dimensions and plans as all the boards I got were packing-cases; other wood I had to cut up from the rough with the adze. I have just got Vol. I. of New Series, and hope to take it with me on my return to Africa."

**Modelling in Clay.—Home-Made Tools for Bookbinders.**

**LADDY.**—You will find articles on Modelling in Clay in Vol. I., Old Series. A very complete series of papers on Bookbinding for Amateurs runs through Vols. I. and II.; and an article on Home-made Tools for Bookbinders will be found on page 515, Vol. I., Old Series.

**Bookbinding.**

**WORKMAN.**—If you are forty years of age I would advise you not to enter the trade of bookbinding. It is one thing for a man to learn a portion of a trade as amusement and another for a man to enter it, at your age, in order to gain bread. Seven years is the term of apprenticeship. "Art of Bookbinding" is now out of print, but a second edition, enlarged, is now going through the press. Meager and Co. have given up business, but presses, etc., may be had from Messrs. Harrild and Co.'s *Farrington Works, Farrington Street.*

**Photo-Lithography.**

**F. S. M.**—The best work on this subject, that I know of, is "Collotype and Photo-lithography," published by Iliffe and Son, 3, St. Bride St., Ludgate Circus, E.C., at 5s. The information is so clear and full that if you follow it implicitly you cannot fail.

**Gas Engine Making.**

**R. H. COOPER, R. C. COOK, AND OTHERS:**—On page 48 of the present volume I stated, in reply to **SUBSCRIBER FROM THE FIRST** that if I received sufficient demand for papers on this subject to show that they would be generally acceptable, they should be forthcoming. The votes of all who have written me on the matter have been in favour of such a series. It is, therefore, carried unanimously, and I have requested a thoroughly practical man to write the articles. I am also trying to arrange that the author shall supply castings of the engine described, but this is not yet definitely settled.—**ED.**

**INFORMATION SUPPLIED.****Electric Lighting and Gas Explosions.**

**GEORGE EDWINSON** writes:—"Kindly allow me at once to set the mind of **CLERICUS SECUNDUS** at rest respecting

any danger of exploding the gas in the pipes, to be apprehended from connecting the wires of an electric bell system to the gas-pipes in a house. It is, as he says,—‘under no possible circumstances could the gas in the pipes be exploded.’

*Electric bell wires* may be connected to gas-pipes with perfect safety, so far as to ensure complete immunity from danger of gas explosion from this cause. This, also, is perfectly true respecting the wires of other electric systems, if we confine ourselves to the theoretical conditions laid down by CLERICUS SECUNDUS. Just here, however, we are confronted with several practical considerations, all more or less pointing to the dangerous nature of such connections when strong currents of electricity are sent through wires connected to gas-pipes. The act of fastening electric wires to gas-pipes, by soldering or otherwise, may cause a leak in the gas-pipe, and this leakage of gas mixing with ‘atmospheric air’ may ‘transform it into an explosive mixture.’ It is, also, more than probable that the connection may be faulty at its junction with the gas-pipe, so faulty, indeed, as to cause heating of the joint when a strong current of electricity (such as that used to light electric lamps, or drive electro motors), is passing. We have now two conditions necessary to cause an explosion. A leakage of gas, forming with air an explosive mixture; and a faulty connection in an electric conductor, liable to spark at any time, or even fuse under the influence of a strong current, and thus fire the explosive mixture. It is just here where the element of danger lies. The explosion would not take place in the pipes charged with gas, but in the room charged with an explosive mixture of gas and air. It is also possible that the sparks from a faulty joint may pierce the pipe and cause an escape of gas. In my articles on ‘Electric Bells,’ I had under consideration a large class of persons who are entirely ignorant of the workings of electric currents. Some of these are afraid of electricity, because newspaper writers conjure up all sorts of dangers to be apprehended from the use of it in our houses. Others are so reassured by a paragraph cut from a scientific journal, as to fear nothing, even when dangerous conditions are present. The currents employed in ringing electric bells rarely exceed the strength of half an ampère, delivered under a pressure not exceeding 6 volts. This must be regarded as a weak current when compared with those of over 10 ampères delivered at a pressure of over 50 volts, the strength

of those employed in even small installations for electric lighting and motor driving. If CLERICUS SECUNDUS wishes for personal guidance in fitting up his house, I shall be most happy to give it; and you may communicate to him my address, or, I will, if he pleases, correspond with him on the subject.” [If CLERICUS SECUNDUS desires to avail himself of your kind offer I shall be happy to forward the address, but may I suggest that your information will be of value to us all.—Ed.]

#### INFORMATION SOUGHT.

##### Wood for Wood Screws.

CLERICUS SECUNDUS asks:—“Will some reader kindly tell me what woods should be used to make wood screws for clamps, etc.?”

##### Photos of Violins.

S. M. L. asks:—“Can any of our musical readers tell me where I can obtain photos of celebrated violins? Have been trying to get some prints for years, but without success, so far.”

##### Mould for Casting Slugs for Air-Gun.

ATHOS writes:—“I should be glad if any of my fellow-readers could tell me how to make a mould for casting slugs for an air-gun in.”

##### Imitation of Ice.

A FOUR YEARS’ SUBSCRIBER writes:—“I am making a model of an Ice Palace. I have tried various materials to imitate ice, without giving satisfaction. Can you, or any of ‘ours,’ give me any information? I really want a substance that can be melted and run into moulds, and yet be hard and transparent like ice, when cold.” [Will not glass meet your requirements?—Ed.]

##### Violoncello.

A. YOUNG (*Tasmania*).—Some long time back an article was promised on “the Violoncello,” but up to the present I have not read or seen in your Magazine anything more about it. I should feel greatly obliged if any of your correspondents would give the following information:—1. Sketch of outline of front Stradivarius “cello.” 2. Sketch of curves for front and back. 3. Depth of sides, or ribs. 4. Thicknesses of front and back. 5. Dimensions and position of sound-bar. 6. Sketch of f-holes and position. I may state that I have made several violins from the instructions given in your Magazine, and all have turned out fair instruments. I have not confined myself to the orthodox wood usually employed, but have experimented with colonial woods. In one or two cases

they have turned out well. A ‘cello I made of Kauri gum and Californian red-pine has an excellent tone. I am now putting together a viola made of the same. I obtained some wood from Messrs. W. E. Hill and Sons, and the violins have turned out to be of very good quality—the backs and ribs being very handsome. Allow me to say that AMATEUR WORK has afforded my friends and self a great deal of instruction as well as amusement, and is proving itself to be a great boon to many Colonists, especially those who have to manufacture everything they require. [The success you have met with in violin making does credit to your skill and patience. If you look in Vol. VII., on page 275, you will find an article entitled, “The Violoncello: How It may be Made.” Had you overlooked this?—Ed.]

##### Mildewed Lens.

PHOTOGRAPHER asks:—“The glasses of a lens I have are mildewed. Would anyone tell me how to put them right?” [I fear there is nothing for it but repolishing.—Ed.]

##### Rope-making Machine.

E. V. E. G. asks:—“Could you tell me how to make a simple rope-making machine to make  $\frac{1}{4}$  inch diameter rope? I want the machine to be worked by hand. I have lent several copies of your Magazine to friends, so I hope that some of them have taken it in.”

##### Varnishing Boats.

MIKADO writes:—“Will any of our boating friends kindly tell me the best method of dressing and varnishing a boat for the coming season’s use on a river?”

#### ANSWERS DEVOID OF GENERAL INTEREST.

KIRKPATRICK (*India*).—I have replied to you by post. G. C. GOODWIN, Junr.—Pleased to welcome you. Shall be glad if you will make AMATEUR WORK known to others in the same way that it came under your notice. A. A. BRADBURN.—Your letter has been forwarded. P. BENNETT.—Repeat your query, and give me volume and page on which the receipt appears. Did you use naphtha or paraffin oil?

#### LETTERS RECEIVED UP TO JAN. 13.

PHOTOGRAPHER; CRISPIN; C. W. COOKE; R. R.; J. A. T.; S. M. L.; N. P. A.; W. L.; W. C.; T. L. M. C.; A. W. T.; ANGLE; R. H. C.; F. S. S.; AND P. A. MULBROW.





# HOW TO MAKE AN ORGAN STOOL.

By W.H. York.

FIG. 1. Scale 3in.-1ft.

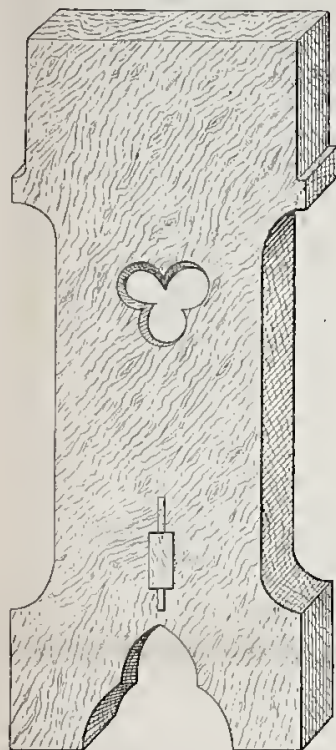


FIG. 2. Scale 3in.-1ft.

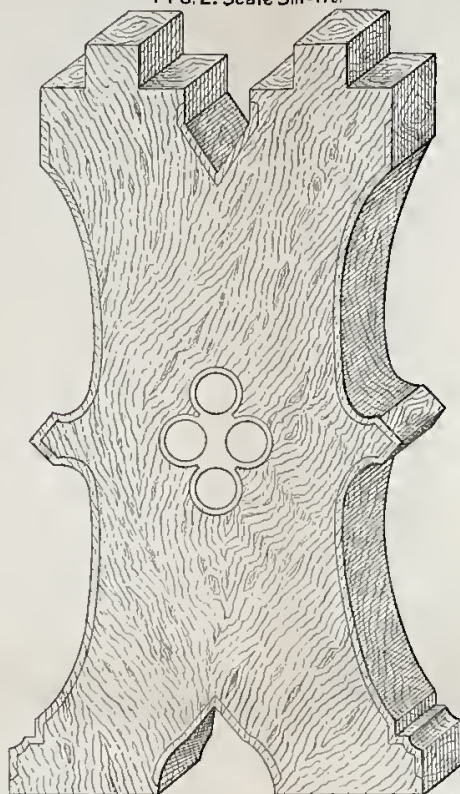


FIG. 3. Scale 3in.-1ft.

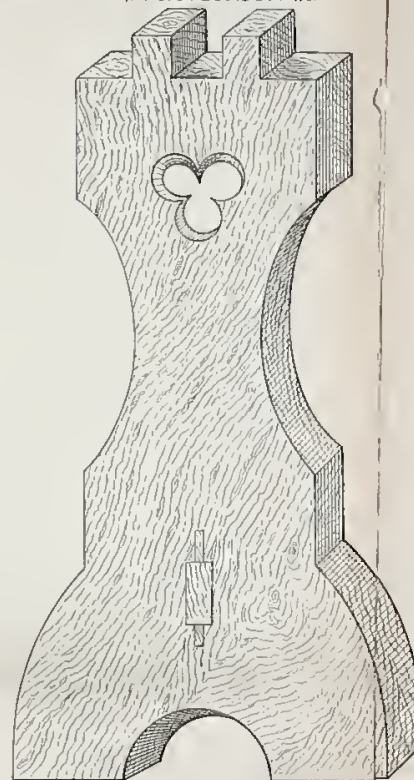
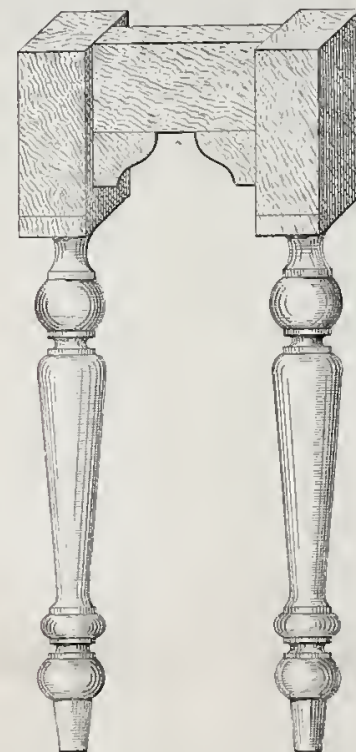
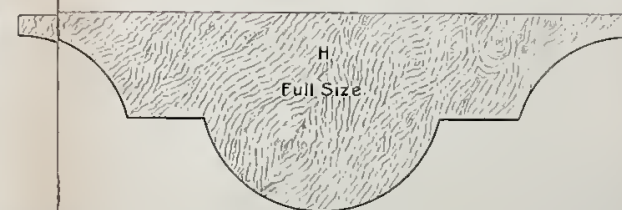
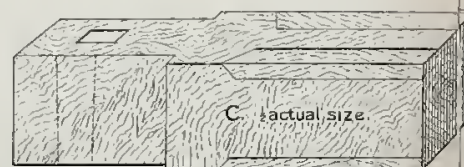
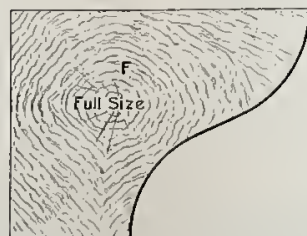
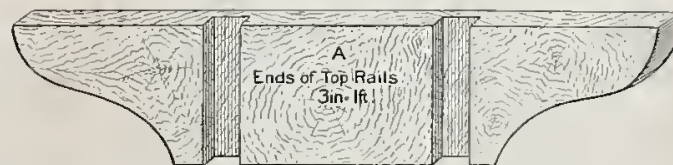
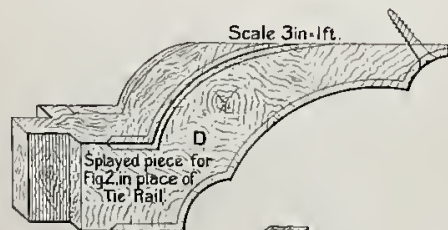


FIG. 4. Scale 3in.-1ft.



Scale 3in.-1ft.



Figs. 1, 2, 3 and 4, show alternative designs for legs of Organ Stools. For details of construction see descriptive text, page 161.







## SASH-MAKING.

By FAUST.

I.—TOOLS AND WOOD REQUIRED.—HOW TO MAKE A  
“DEADLIGHT.”

**S**ASH-MAKING is a branch of joinery that the ordinary amateur generally fights rather shy of. This may, perhaps be accounted for on the supposition that sashes are not in such demand in the amateur's workshop as are other articles in wood; and yet, to those living in a country district, or having a piece of garden ground on which they may erect outhouses, a knowledge of the art of sash-making would be extremely useful. No doubt, to make a sash properly, demands an amount of technical knowledge which the amateur finds it difficult to acquire, but he need not blush at his own ignorance, as many full-fledged journey-men carpenters can no more make a common sash window than they can fly, but, then, these men may have been brought up in a large shop, where the division of labour system prevailed, and may never have had an opportunity of learning that particular branch of the trade. In a series of papers, of which this is the first, I will endeavour to place the art of window-making in as clear a light as possible. Many things, from the nature of the work, will be difficult to explain, even with the aid of drawings, as sash-making is one of those things where one practical lesson is worth more to the learner than much written instruction. I will do my best to be as lucid as possible, and shall

be happy to assist anyone who finds a difficulty in his way by replying to any query he may wish answered. In the present paper I will deal only with common sashes, or “deadlights,” as they are termed, that is, sashes which are a fixture in the wall, and do not open; they are the simplest form of window, and, therefore, the easiest for the amateur carpenter to construct. I would here impress upon the worker the

importance of care and accuracy in his work. Sash work above all other work in wood construction must not be slovenly done, or the result will be a miserable botch. The sash-maker must be exact in his measurements, and in his working to them, and must carefully keep to all his gauge marks.

I will suppose that the necessary tools for ordinary woodwork are already possessed by the beginner, and, in addition to these, he will require a pair of  $\frac{5}{8}$  Gothic sash planes, with templates, a sash fillister, and a sash bar or “astragal” fillister, also a  $\frac{5}{8}$  inch flat sash gouge. These tools are rather expensive, but they may be picked up very cheap sometimes at a second-hand shop. Having

the tools, and a good strong bench to work on, we must turn our attention to the wood. Sashes are generally made from good red deal, as free from knots and blemishes as possible, and the necessary pieces may be purchased cut to size. In London and other large places you may purchase the wood in lengths, with the cheeks and mouldings already run on, so that you have but to mortise and tenon your framing, and it is ready for putting

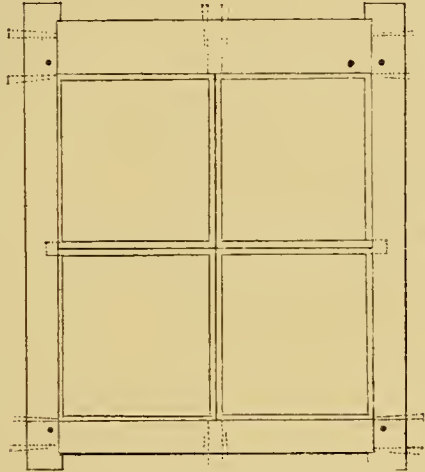


FIG. 1.—FIXED SASH OR “DEADLIGHT.”

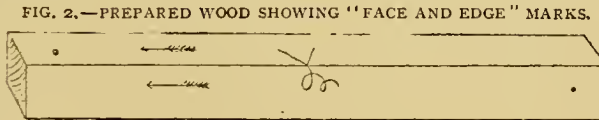


FIG. 2.—PREPARED WOOD SHOWING “FACE AND EDGE” MARKS.

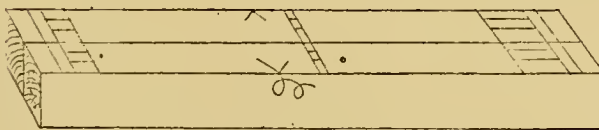


FIG. 3.—STILE “SET OUT” FOR WORKING.

together; but I should not recommend the amateur to purchase his wood in that way, it is better to work out your own material, your setting out is much more easy and accurate, and your job is, when finished, of a more substantial nature than if you used the ready-moulded framing, which, in fact, is only used in the trade for jerry jobs.

We will suppose that we have to make a sash similar to that shown in Fig. 1, that is, 2 feet wide, and 2 feet 4 inches high, divided into four panes. For this we must get two stiles, as the upright pieces are called, 2 feet 8 inches long by  $2\frac{1}{2}$  inches wide, and  $2\frac{1}{4}$  inches thick; one top rail 2 feet 1 inch long by  $2\frac{1}{2} \times 2\frac{1}{4}$  inches, and one bottom rail 2 feet 1 inch long by  $3\frac{1}{2} \times 2\frac{1}{4}$  inches; also one sash bar 2 feet 5 inches, and another 2 feet, both of these bars are  $2\frac{1}{4}$  inches wide and  $\frac{5}{8}$  inch thick. I have given the sizes which the wood should be after it is planed up, so that it should be got a little fuller to allow for planing and squaring.

Having got your wood, proceed to plane it, find out which way the grain runs, select the side and edge which run in the same direction, as shown by the arrow marks in Fig. 2, that is, from right to left; plane up the side of the piece quite true, then the edge, squaring it very exactly, put marks on both planed surfaces, as shown in Fig. 2, these are called face and edge marks, and serve to guide the worker in setting out, squaring, and moulding his material. The reason that I have told you to select a face and edge that run in the same direction, is that when you are checking and running the moulding the wood may not tear up, as it would if you used the planes against the grain of the surface. When you have planed up your face and edge, set your marking gauges to the width and thickness, and plane very exactly up to your gauge marks. When you have done the four pieces for the framing, proceed to do your sash bars; for the *width* of them use the gauge set to the *thickness* of the framing, and be careful to thickness them exactly to  $\frac{5}{8}$  inch.

Having prepared your material, you can now proceed to set out, or, as it is called in some parts of the country, draw in, your window,

viz., to make your lines, showing where your framing is to be mortised and tenoned. This part of the work demands a little thought, and it is more than likely that you may spoil your first window over it; still, if you follow the instructions I am about to give, and endeavour to understand clearly what you are about, before cutting out your mortises or tenons, you ought to succeed at your first attempt. Take your two stiles, lay them on the bench in pairs, that is, with the marked edges up, and the two marked faces to the outside; a reference to Fig. 3 will show you how they ought to lie. Mark off the extreme height of your sash, which in this case is 2 feet 4 inches (your stiles are longer than this, so let the extra length go equally to each end), square across the edges of both stiles, making the mark with a cutting knife or sharp chisel, but do not cut very deep, just a clear mark breaking through the skin of the wood; measure in from each of these marks the width of your rails, that is, at one end  $2\frac{1}{2}$  inches, and at the other  $3\frac{1}{2}$  inches; square them across as before, divide each of the spaces into three equal parts, make another mark across the edges, leaving one part to the outside, and two parts to the inside of each, the inside is the mortised part, and the outside part is left solid.

Now divide the stile, between the mortise marks, into two *equal* parts, this gives you the centre of the sash bar, mark off  $\frac{5}{8}$  inch on each side of this centre mark, and square across, this gives the  $\frac{5}{8}$  inch mortise for the bar. Fig. 3 shows these marks on the edge of the stiles, with the mortises. Now, you must repeat these marks on the other edge; to do this grasp the stiles tightly between the fingers, turn them over on their side, taking care that they do not shift in the turning, with a pencil mark where your mortises come, across the side, and then square across on the back edge; you must make the mortises a little wider at the back edge, to allow of the insertion of the wedges which you fasten the sash together with when finished; do not square across the sash bar mortise, as it only requires to go into the stile about an inch or so, although the other bar will have to go right through the rails, the

reason for this will make itself apparent to you when you come to put the framing together. If you are making more than one sash of the same size at once, you can set out all your stiles at one time, by laying them side by side in pairs; if you have many it is best to place a cramp across them and tighten it gently, so that when you turn them over they may not slip from their position, and so cause inaccuracy of marking.

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## PAPER HANGING.

By HENRY L. BENWELL.

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V.—DAMP WALLS AND DIFFERENT METHODS OF DEALING WITH THEM—CLEANING WALL PAPERS—DISINFECTING.



THE TREATMENT OF DAMP WALLS.—There is nothing which causes the paper hanger so much annoyance and inconvenience, nor causes the complete ruination of papers quicker, than damp walls. A little practical and old reliable information on this point may, therefore, prove valuable, not only to those who are interested in the subject upon which these articles treat, but to a great many more who are suffering from that demon, damp, in a more or less degree.

In nearly nine cases out of ten this damp is found to rise from the foundation, and the very best way of curing it, when it comes from this cause, is to have a course of bricks removed a little above the ground, and a damp course inserted. The damp course of the ordinary builder usually takes the form of well-boiled gas-tar and clean, dry sand, but I have never yet been brought to believe that its effectiveness will last out the life of the house itself. A very effective damp course can be made with a course of Staffordshire best blue bricks set in Portland cement and sand, with a layer of tar and sand top and bottom of the said bricks. This may be reasonably expected to last some time, but the jerry builder will not go to the trouble and expense of this method, he pretends to show that a damp course has been properly inserted, in order to sell his house, and that is all he cares about. Of course, inserting a damp course in this fashion is a somewhat expensive affair, and

people who only rent property or hold it on lease would not care to spend so much money, but they may endeavour to get the superior landlord to carry out the improvement.

The reader must here be doubly cautioned against inserting a damp course without making perfectly sure that the damp really rises from the bottom, as even when such has been proved to be the case, it has not always effected a cure, and, then, no doubt, damp arises from other quarters as well. In the best of cases some time must be allowed for the wall to dry out after a new damp course has been inserted.

There is yet another and cheaper plan to allay this nuisance of ground damp, and although it does not improve matters in the wall itself, it at least keeps the paper on for an indefinite period and the paper is, consequently, quite dry, even in the worst of weather. We first of all strip the walls of all old paper and clean them, as directed in the opening chapters, we shall now be able to see which portions of the wall are damp and which are dry. For instance, all of one or two sides of a room may be damp, or the wall on one side of the room only (the most common case) may be affected at bottom to a height of about 3 or 4 feet. In the latter case we draw a line along the wall with a pencil and straightedge well above the damp part, and then, with a plasterer's hatchet or an old hatchet as used by firemen, chip away all the plaster until the bricks are exposed and clean.

We next nail some battens along the wall in a horizontal direction and about 2 feet apart. Now procure some thin boards and saw them off to the requisite lengths, to cover in the space between the skirtings and the plaster that remains, and nail up with cut nails. These boards are afterwards covered over with coarse canvas, as sold at the paper hanging warehouse for the purpose, and the wall thus doctored is ready to receive the new paper. This is an excellent plan and never fails, as a current of air is always present between the bricks and boards. I must add that the combined thickness of the battens and the boards must be such as to come flush with the remaining plaster when they are put up. The canvas can overlap on to the plaster a



little, being stuck on with a mixture of paste and glue. Tinned tacks may be used for attaching it to the boards, care being taken to stretch it tight. Some years ago the wall on one side of the entrance hall in the house where I resided was a great nuisance when the atmosphere was in a certain condition, and it used to "sweat" tremendously, the water running down it in streams; consequently, we could never keep any paper on the wall, which was always being re-papered. The paper hanger first tried to remedy the defect, but he made a very poor attempt; a well-known firm of builders and decorators were then called in, and they covered the wall with thin sheet lead, which, in fact, I afterwards had to remove, this did not improve matters in the least. Other work outside was afterwards undertaken, but without avail, so one morning I called in a carpenter, and we two stripped off the lead, had the plaster down, and before night had the battens, boards, and canvas on. Next day came the paper hanger, and with some paper which we had stocked for frequent re-paperings, made a neat and matchable job. Since then, quite fifteen years ago, the wall has been no trouble whatever.

Walls are often damp from sources easily removable. When I first entered the house I now live in a portion of one wall in my study was very damp, also a similar patch existed in one of the top bedrooms, which faced exactly the opposite way; now I always go outside first to endeavour to ascertain the cause, and in both cases I found stackpipes, which on examination were found to be broken and so let the water from roof down the exterior of the walls; on these being renewed the dampness ceased. Defective stackpipes are often the cause of damp walls.

*Damp-proof Paints.*—There are several paints of this description in the market, one such being the Magnetic Iron Paints manufactured by H. Thompson & Co., 95, *Marrow Street, Walworth, S.E.* It is claimed to be non-poisonous, free from smell, and "a sure cure for damp walls." It can be used for exterior or interior work, and can be painted or papered over. A sample 7lb. tin can be had for 3s. 6d.,

ready for use. Pulford's Damp-proof Paints are also well known. The theory of these damp-proof paints, which have for their basis oxide of iron ( $\text{Fe}_2\text{O}_3$ ), is that each coat of paint applied to the wall forms, when dry, a thin sheet of iron, and so prevents the damp coming through to the paper, just the same as when thin sheet lead is applied. This sheet lead, which is so thin that it can be cut with a pair of scissors, can be used in some cases, and can be had at any large decorator's or builder's shop. These people also sell a special waterproof paper, which may be put on in front of the ordinary paper, but I myself have never given it a trial. I may mention one more process for keeping the damp away from the paper, and one which I have used with success, and that is to coat the plaster with two or three good dressings of patent knotting, first getting the wall as dry as possible with the aid of a fire and keeping the room well ventilated to allow the moist air to escape. Damp walls are best seen to in the summer after a spell of dry weather.

*Cleaning Wall Papers.*—The paper of room should first be cleared by tying a soft clean duster over a broom and carefully sweeping the walls down with it. Next cut a stale quartern loaf into eight pieces, and taking one piece in the hand commence rubbing the paper at the top with a light downward stroke, and continue all round the room till the whole surface of the paper has been cleaned. As the bread gets dirty, cut a slice off as required. The bread should be three days old. To remove grease from papers, dip a piece of flannel in some spirits of wine and rub the greasy spots once or twice very gently.

I think enough has now been said upon the subject of paper hangings and paper hangers, but, I trust, readers will note carefully the remarks made in the two first chapters on cleanliness and sanitation, and I do not think I can do better than conclude these short papers with a quotation from *The Lancet* on "Thorough Disinfection":—

"Recent experience has proved the insufficiency of the ordinary process of disinfecting dwelling-rooms, without at the same time stripping off

the paper and washing the walls and painted surfaces with caustic soda. In Manchester nearly all the men engaged in this duty have had fever or infectious disease, although the houses previous to their visits had been disinfected with chlorine, carbolic acid, etc. It is believed that contagious matter is retained in the paper, particularly when a number of layers have accumulated on the walls. In some cases the men removed as many as fifteen coats of paper, and they describe a fusty odour, which of itself may possibly give rise to fever.

"We would recall to our readers the case of the Knightsbridge Barracks, where the accumulation of successive layers of size and paper formed a *nidus* for thousands of maggots. We must not, therefore, be satisfied with mere cleaning, whitewashing, and re-painting, but insist, also, on the cleansing and scouring of the walls."

I may add that this last paragraph applies strongly in cases where there have been cases of measles, scarlet fever, and small-pox, even after the room has been subjected to sulphur fumes by the local sanitary authorities. It should also be widely known that putting a person into an infected room is now a criminal offence, for which the punishment is very heavy, and in case of death, I am not sure as to whether it does not amount to manslaughter in the eyes of the law.

Even if these papers are read by those who have no inclination to do their own papering, they will at least give them some idea as to how the workman should execute his work, and, therefore, be in a position to give the necessary directions and also to superintend the operations, so that their homes may be the centre of health, happiness and beauty.

I fully agree with Mr. Benwell that the damp course of the ordinary builder will not last out the life of the house itself. *Experientia docet.*—ED.

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BOTTLES containing developing solutions should always be kept filled to avoid oxidation. This result may be obtained by replacing the liquids used by fragments of glass.—*Wilson's Photographic Magazine.*

## ELECTRIC TOY-MAKING.

### THE ELECTRIC TRAMCAR.

By ROBERT W. COLE.



HIS toy, the side view of which is shown in Fig. 1, is a working model of an ordinary metropolitan tramcar. Its main parts are a wooden frame, which contains the wheels and axles; the body of the car, in which are inserted the doors and windows; and the roof, with its various appurtenances. Inside the body of the car are placed the electric battery and motor, which are intended to drive the car.

In describing the car, I shall first give the dimensions of the various parts of a car, the extreme length of which is 2 feet; but the reader can easily make it larger or smaller, more elaborate or less elaborate, according to his taste, and his skill in the use of tools.

The first thing to which we will turn our attention to is the construction of the wheels and their axles. The former may be made of some hard wood or of metal. To make the latter, turn two pieces of boxwood or iron into the shape shown in Fig. 2, so that the thick parts of each are  $\frac{3}{4}$  inch in diameter, the thin parts of each  $\frac{1}{4}$  inch in diameter and  $\frac{3}{4}$  inch long, and the distance between A and B is 5 inches. Next, cut screws on the two projecting ends, and carefully remove, by means of a file or on a lathe, the threads of these screws for about a quarter of an inch from the end of each axle. When you have done this, turn four flanged wheels, 3 inches in diameter, such as are used for model engines. Make the flanges on each wheel of the same thickness, and be very careful that the flat part of each wheel, which rolls on the rails, is exactly of the same diameter. Then drill holes through the centre of each of the wheels a little less than  $\frac{1}{4}$  inch in diameter, and cut screws inside these holes, so that they will screw on to the axles. Next, procure a cogwheel,  $\frac{1}{4}$  inch less in diameter than the wheels are, and bore a hole through it, so that it will fit tightly on to one of the axles. When you have done this, solder on to each side of the centre of the cog-

wheel a piece of brass, about  $\frac{1}{4}$  inch thick and 1 inch in diameter. Chuck the wheel on a lathe, and drill a hole right through the two pieces of brass, as large as that which you have already made through the wheel. The object of these two pieces of brass is to make the cogwheel revolve without wobbling. Now fix this wheel on one of the axles, and at a distance from its end equal to  $1\frac{1}{2}$  inches, and screw the flanged wheels in their places on the axles. The wheels and their axles will now have the appearance presented by Fig. 3. The cogwheel should have its teeth so large that a wheel  $2\frac{1}{4}$  inches in diameter would have seventy teeth. If you do not happen to have such a wheel in stock, you can easily get an old one from a watchmaker.

The next part to which we will turn our attention is the framework which carries the wheels, or the side frames, as we will in future call it. To construct this, procure two strips of mahogany 20 inches long,  $\frac{1}{2}$  inch thick, and 2 inches wide; and two lesser strips of the same width and thickness, but  $5\frac{1}{2}$  inches wide. Drill holes  $\frac{1}{2}$  inch in diameter, 7 inches from the end of each of the longer strips, and midway between each edge. Prepare four pieces of stout sheet brass or iron, 1 inch square, and drill holes in the middle of each piece of such a size that the projecting ends of the axles may easily revolve inside them, and then screw them over the holes already made in the two lesser strips of mahogany, and on the same side of each strip. These holes are intended to form the bearings of the axles, and should be exactly in the same position on each of the mahogany strips. Now firmly fix the four strips of wood together, as shown in Fig. 4, so that the two longer ones may overlap the two shorter ones, and that the four pieces of brass which form the bearings are placed on the inside. Now cut away the lower edge of one of the short strips, so that it is made  $\frac{1}{4}$  inch less in depth than the other one, and cut a rebate round the top of the outside edge of each of the strips,  $\frac{1}{4}$  inch wide and  $\frac{3}{4}$  inch deep; and then plane a piece of wood  $\frac{1}{4}$  inch thick,  $4\frac{1}{2}$  inches long, and 6 inches wide; shape it as shown in Fig. 5, and screw into the place which you have prepared for it by cutting away the wood along the lower edge of one of

short wooden strips. If the frame does not seem strong enough, screw on its lower side, across each of the four joints, a piece of stout iron or brass, in the position shown in Fig. 4.

You will have now finished the framework of the car which holds the wheels in their places, and you may now fix on to it the wheels and axles, placing small washers on the projecting ends of each axle, taking care that the rebated edge of the framework is placed uppermost. To insert the axles in their bearings, you will have to take off the pieces of brass which serve as bearings, place them over the axles, and then screw them in their places again. The stage of construction which you have now reached is represented by Fig. 6, the axle to which the cogwheel is fixed being marked A, and the other one B.

We will now turn our attention to the body of the car. This is composed of four pieces of wood,  $\frac{1}{4}$  inch thick and 6 inches wide, fastened together in the shape of an oblong box, two of them being exactly equal in length to the framework of the wheels, and the other two being  $\frac{1}{2}$  inch less in length than the framework is wide.

You must now cut a series of windows in the two longer pieces of wood, as shown in Fig. 1, and a door in one of the short pieces. Get some red or green cloth, cut off small pieces, and glue them inside the two long pieces of the body of the car, so as to cover up all the windows and to give the appearance of blinds. Then, with a fret-saw, cut off from the middle of one of the sides an aperture about 5 inches high and wide, and fit into this aperture, by means of hinges, the piece of wood which you have cut out from it. This will form a door, through which it is intended to introduce the battery cells which work the car. Now fit a piece of wood on to the top, to form the roof, and nail strips of wood,  $\frac{1}{4}$  inch thick and  $1\frac{1}{2}$  inches wide, along both the sides and the ends of the top of the body, and make their lower edges level with the roof. The piece of wood which forms the roof should project 4 inches from the body, at the end where the door has been cut, and 1 inch at the other end.

Fig. 7 shows in section the end view of the



body of the car, and the various parts of the roof, as you have now constructed them; *A, A*, are the two sides; *B* is the roof; *c, c*, are the strips of wood running round the roof; and *D, D*, are the two side frames containing the wheels *E, E*. Procure a fret-saw, or a fine key-hole saw, and with it cut the projecting end of the roof, for about 3 inches in length, into the form shown in Fig. 8, where *A, B*, is the projecting end of the roof, and *A, c, D*, is the part of it which has been cut out. The roof must now be fitted with a seat, which must extend from the part of the roof already described to the other end. This seat is shown in perspective in Fig. 9, and should be constructed of  $\frac{1}{4}$  inch material 2 inches wide. The end piece, *A, B*, should be 2 inches wide at the top, and slightly wider at the bottom. The various parts should be glued together, and the whole seat should be firmly fixed or screwed on to the roof of the car. The body of car will then be complete, and, if accurately made, will fit neatly over the rebate cut all round the outside of the framework of the wheels, on to which it should be screwed, so that it can easily be removed if you require to get at the electric motor which is intended to be fitted inside it.

The next part of the tramcar which comes under our consideration is the electric motor. This you may either buy ready-made at the shop of any dealer in electrical goods, or you may make it yourself. If you intend to adopt the latter method, the best form of motor which you could use is a small dynamo electric machine, which has already been described in Vol. IV. (Old Series) of *AMATEUR WORK*, page 316; and I should strongly advise you to do this, as you will thus obtain one of the most highly efficient forms of electric motor. There are several other kinds of electric motors in existence, but, as I believe that one is already being described by another writer, I cannot say anything about them here without infringing on his papers. Whatever kind of electric motor you decide on having, its extreme breadth must not exceed 4 inches, and it must have a portion of one of the ends of its axle made of eight-leaved pinion wire, which will fit the cog-

wheel already fixed on to one of the axles of the wheels. Now procure a piece of mahogany  $\frac{1}{4}$  inch thick,  $19\frac{1}{2}$  inches long and 6 inches wide, and fit it on to the top of the framework represented in Fig. 6, and cut slits in it, through which the wheels of the car, and the cogwheel which is attached to one of the axles of the driving wheels, will be able to revolve. For the sake of future reference we will call this piece of wood the floor of the car. Procure another piece of wood,  $\frac{1}{2}$  inch thick, of nearly the same breadth as the floor of the car and about a foot in length. Fix the electric motor as firmly as possible, nearly at one end of this piece of wood, which is intended to be placed at one end, *P*, of the tramcar (see Fig. 1), and in such a position that its axis will be at right angles to the length of the car; the motor must have, as was previously stated, a portion of its axis consisting of pinion wire. This pinion wire should have about eight leaves, and should fit the cogwheel which has been fixed on to one of the axles of the wheels.

The motor will have to be connected with the driving wheels by means of cogwheels, the teeth of which must fit into the teeth of the cogwheel and pinion wire which has already been used. Fig. 10 shows the ground plan of various pieces of mechanism by means of which the connection between motor and driving wheels is obtained. Of course, the connections may be made by means of pulley wheels and a belt, in that case the cogwheel on the axle of the driving wheels should be replaced by a pulley wheel of the same diameter, and a smaller pulley wheel,  $\frac{1}{2}$  inch in diameter, should be placed on the axis of the motor, the two pulley wheels being connected by a belt of catgut. But since belts are untrustworthy, on account of their liability to slip and become slack, it is better to make use of the somewhat complicated, but more sure, method of connection by means of cogwheels. But to return to Fig. 10: *A, A*, are the two driving wheels; *B* is the axle connecting them; *c* is the cogwheel on the axis of the driving wheels, and should not be fixed until all the other cogwheels have been fastened in their places; *D* is a small piece of pinion wire, 1 inch

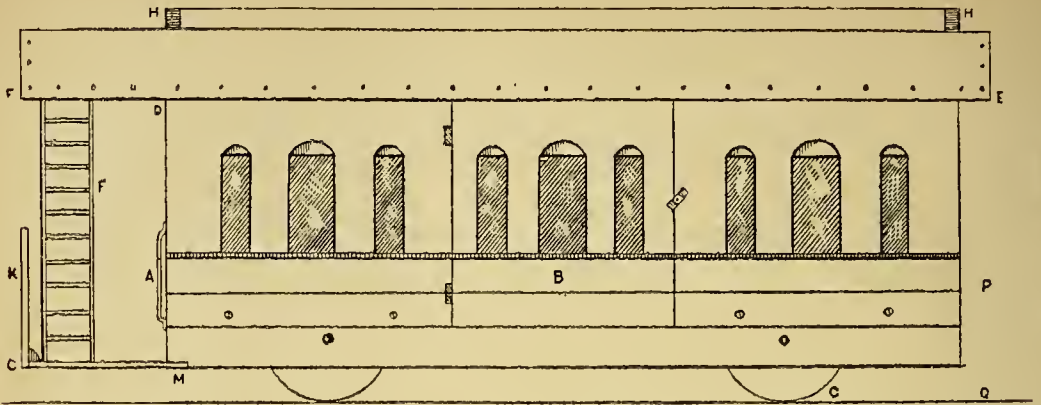


FIG. 1.—SIDE VIEW OF TRAMCAR.—A, End of Car, containing doorway, ladder, and landing-place; B, Door in Side of Car for inserting Battery; C, Landing-stage; D, Projecting part of roof; E, E, Ledge nailed round roof; F, Ladder; G, Driving wheel connected with Motor; H, H, Seat on Top; A, P, Top edge of Side Frames; Q, Q, Rails on which the Car run.



FIG. 2. Axle for Wheels

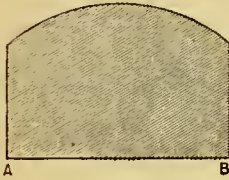


FIG. 5 Landing stage.  
at end of car.

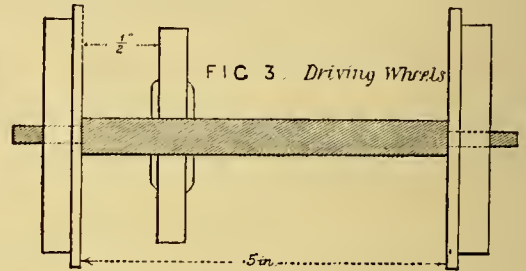


FIG. 3. Driving Wheels

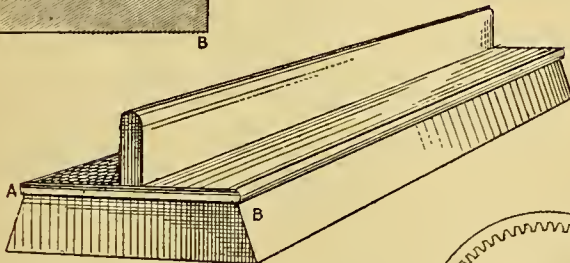


FIG. 9. Seat on top of car.

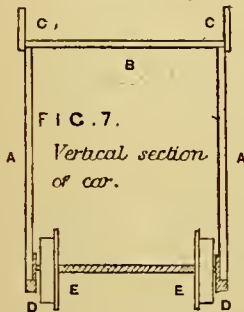


FIG. 7.  
Vertical section  
of car.

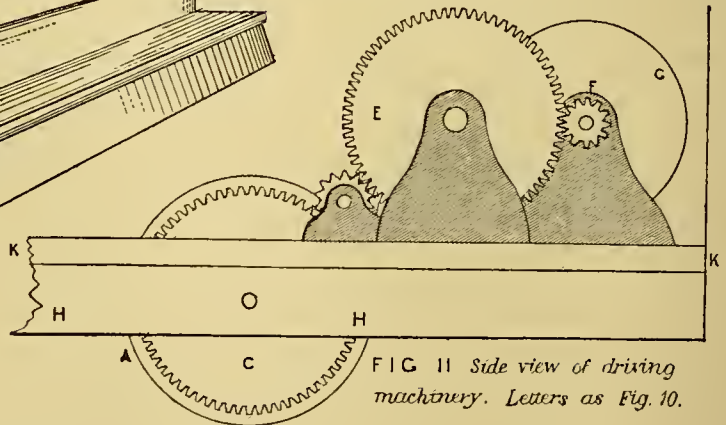


FIG. 11 Side view of driving  
machinery. Letters as Fig. 10.



FIG. 13  
Method of connecting rails. A Iron band B Iron brace C Nuts & bolts.

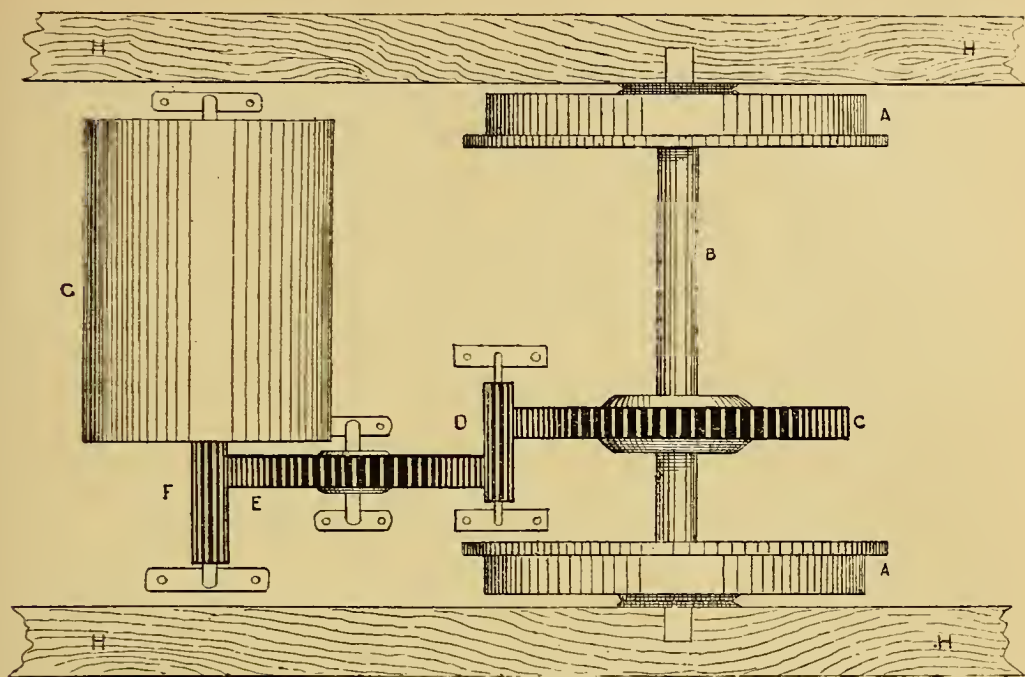


FIG. 10.—DRIVING WHEELS AND MOTOR CONNECTED BY COGWHEELS.—A, A, Wheels of Car; B, Axle; C, Cogwheel fixed to Axle, B; D, Piece of Pinion Wire; E, Cogwheel; F, Pinion Wire on Axle of Motor; G, Electric Motor; H, H, Side Frames of Car.

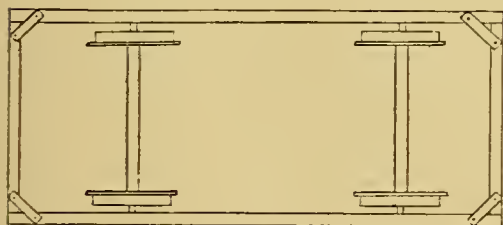


FIG. 4 Framework of car with wheels in position.

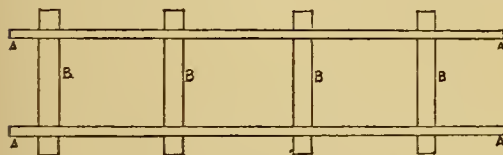


FIG. 12. Tram line. A Iron band. B Sleeper

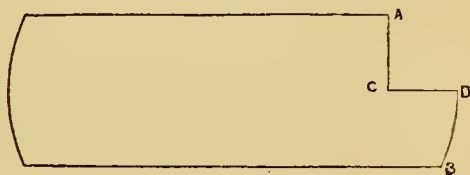


FIG. 8. Roof of Car

long, and having its two ends for about  $\frac{1}{4}$  inch turned or filed to form axles, on which it can revolve; E is another cogwheel of the same diameter as C, and which is fitted on to an axle which accurately fits it in the same manner as C, and presses against the pinion wire, F, which is on the axle of the electric motor, G; H, H, are the side frames, between which are pivoted the wheels of the car. All the pieces of pinion wire and the cogwheels should fit one another exactly; the cogwheel, E, and the pinion wire, D, must be fitted with the same bearings as the wheels of the tramcar, and all their supports should be fastened on to the same

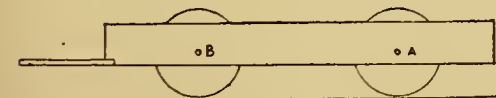


FIG. 6 Side frame with wheels in position.



piece of wood to which the electric motor is fixed. Fig. 11 shows a side view of the cogwheels all fixed in their places, the various parts being denoted by the same letters as in Fig. 10.

The supports of the cogwheels may be made of any hard wood, or of metal, and should be screwed on to their places on the piece of wood to which the motor has been fixed. Care must be taken that they are fixed immovably on to the piece of wood to which the motor is fixed, that they revolve truly in their bearings, and that the pinion wire, *d*, is placed so that it does not interfere with the rotation of the flywheel. When you have arranged all these cogwheels in their places, take off the body of the car, and place the piece of wood containing the electric motor and its various appurtenances on the floor of the car so that the piece of pinion wire, *d* (Fig. 11), presses against the cogwheel, *c* (Fig. 11). You will probably have to cut a slit through this piece of mahogany (represented by *k*, *k*, in Fig. 11), in order that the cogwheel, *c*, may revolve without any obstruction. When you have done all this, carefully fix the motor, etc., firmly down to the floor of the car with screws or nuts and bolts. You must, also, before fixing it down, cut slits in *k*, *k*, to allow the flywheel, *a*, *a* (Fig. 10) to revolve without any obstruction. You must now connect the motor with the battery by means of binding screws. Procure two binding screws, fix them on the outside of the middle of one of the sides of the car, lead two wires from them to the electric motor, and when you have placed the battery inside the car, lead two wires from it, and fasten them to the same binding screws to which the wires from the electric motor are fixed. Now fix the body of the car firmly in its place by means of small screws, or nuts and bolts, passed through the side frames and the places where the side frames meet the sides of the car.

The chief parts and machinery of the car are now complete with the exception of the ladder, by means of which the passengers ascend to the top of the car. To make this, procure two pieces of thin wood, long enough to reach from *c* to *d*, Fig. 1, about  $\frac{1}{4}$  inch thick and  $\frac{1}{2}$  inch wide, and glue strips of wood at equal distances

apart, across these to serve as the rungs of the ladder. Then fasten the ladder against the part *a*, *d*, of the roof (see Fig. 8), and leave it unfastened at the bottom, but in such a way that it presses rather tightly against the projecting ledge of the car (Fig. 1).

A piece of mahogany placed as shown in *c* *k*, Fig. 1, will add greatly to the general appearance of the car; or the same result may be obtained by the addition of a light iron railing in the same place. If *c* *k* is to be made of wood, its edges should be neatly bevelled off, and it should be made of material  $\frac{1}{4}$  inch thick.

When you have finished the machinery of the car, and before you fix the body in its place, try the electric motor by means of an electric battery, in order that you may see if all the machinery works properly, which it will do if you have made everything according to directions. When you have done this, screw all the various parts of the car in their places, open the door in the side of the body of the car, and insert the electric battery which is to be used for driving the car. The kind of battery which you use may consist of one or more cells of Bunsen's, Groove's, Smee's, or the bichromate battery. If the latter is used it will be necessary, when it is not in use, that the zinc plate should be drawn up from the liquid; and for this purpose the bottle-shaped cells, which are sold at the shops of most dealers in electrical goods and which are fitted with a brass rod for drawing the zinc plate out of the liquid, are admirably adapted, and can, by a little manipulation, be fitted so that the brass rod passes through the roof of the car. The number of cells required will depend upon the kind of motor which you have used, and upon the accuracy with which the moving parts have been constructed. One cell, pint size, ought to be enough to move the car, and in no case ought more than three cells to be required. Of course, if you want the car to go very fast, you can use more than two cells, and arrange some more in another truck or car fastened to the one containing the motor, so that it can be drawn by it. The bearings of the wheels, and the various other moving parts,

should be slightly oiled with machine oil before the car is used.

We will now turn our attention to the rails on which the car is intended to run. To make these, procure some band iron 1 inch wide and  $\frac{1}{8}$  inch thick, and cut it into strips about 4 feet long. Then procure some pieces of wood 8 inches long, 1 inch thick and wide, and on each piece cut with a saw two slits  $\frac{1}{2}$  inch deep, and wide enough for the iron band to fit into them, and make them at a distance apart equal to the distance between the flanges of the wheels less by about  $\frac{1}{8}$  inch. Then place these pieces of wood in a row on your workbench about a foot apart, and fasten the strips of iron into the saw cuts. When you have done this, you will have lengths of rails four feet long, as shown in Fig. 12, where A, A, are the strips of iron on which the car runs, and B, B, are the pieces of wood to which the iron strips are fastened, and which are called in technical language, "sleepers."

The lengths of rails may be easily fastened together by fixing some iron braces across the junction by means of nuts and bolts, taking care that the braces are fixed on the outside of the iron band, and not on the inside. The method of connecting the lengths of rails is shown in Fig. 13, which shows an enlarged view of the junction as viewed from above; A, A, are the two strips of iron to be joined, B is the piece of iron, about  $\frac{1}{4}$  inch thick, which is fixed across the junction, and C, C, are the two nuts and bolts which fix it to A, A.

If you wish, you can make circular rails instead of straight rails, but in that case the axle of the two wheels of the car to which the motor is not connected must be made to turn round in the same manner as the front wheels of a cart or carriage do. This may easily be effected by making the bearings in which the axle revolves so that they can slide for about two inches along the side frames, and making the two projecting ends of the axles (see Fig. 2) about  $\frac{1}{4}$  inch longer than previously described. The two pairs of wheels of the car ought, in this case, to be placed nearer together. The circular rails may be constructed in the same way as the straight rails, and the sleepers should

have holes drilled through their ends so that they may be screwed on a floor in a circular form.

No mention has as yet been made with regard to the material which must be used for finishing off the woodwork of the tramcar. This may be either varnish, polish, or paint, according to taste; if paint is to be used, and the material to be painted is either mahogany, walnut, oak, or any other hard wood, Aspinall's Enamel would form a very suitable substance for painting it with, and could also be used for finishing off the sides of the wheels of the car and some of the machinery. This painting, varnishing, or polishing, should be done before the various parts of the car are fixed in their places.

The construction of the tramcar is now complete in every respect, and, in conclusion, I may add that it may be constructed larger or smaller than I have described it, according to the option of the maker, without any detriment to its appearance.

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## TWO SIMPLE FANCY BRACKETS.

By ED. C. ROE, Jun.

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**I**N sketching out the brackets which I am about to describe, it has been my endeavour to design them so that the construction need take but few hours, but at the same time have endeavoured to make them a little fanciful, that the result of our labour may be more satisfactory and pleasurable to us.

The idea is not so much to produce pieces of cabinet work, but rather to simplify the matter to such an extent, as to bring them to the level of average fretwork, which, as a rule, is not what we should call substantial, but at the same time is sufficiently strong to answer the purpose for which it is intended.

If, when completed, the brackets are enamelled with some of the enamel paint, of which we see and hear so much, they will be found to look extremely pretty, and help to fill up one of those odd corners, which are to be

found in nearly every room, with advantageous results. I do not think it necessary to occupy your time or the Editor's space with a description of the methods used in enamelling, as the published instructions are to be found in every home or workshop, if we may judge from the quantity distributed by the manufacturers.

The whole of the materials used will not be required thicker than a quarter of an inch, and if yellow pine be used, it will be found everything that is requisite, as well as being comparatively easy to work.

For No. 1 bracket we shall require the following pieces of stuff carefully planed up :

Two pieces, 1 ft. 1 in. long,  $4\frac{3}{8}$  in. wide, sides.

Two pieces, 1 ft. long,  $4\frac{3}{8}$  in. wide, shelves.

One piece, 1 ft. long, 2 in. wide, shelf.

Two pieces, 1 ft. long, 1 in. wide, frets.

The elevations are drawn one-fourth full size; there should be no difficulty in sketching out the patterns full size on the stuff. The ornamental cutting may be executed with a fretsaw expeditiously, and when the various parts

your nails, which, by the way, should be  $\frac{5}{8}$  inch or  $\frac{3}{4}$  inch wire French nails, or if obtainable,

some of the oval wire brads now in the market. If carefully and judiciously nailed, I think the whole will be sufficiently strong for our purpose.

No. 2 bracket will require a little more time spent on it, but looks neat when completed. For this we require :—

Two pieces, 1 ft. 2 in. long, 5 in. wide, sides.

Two pieces, 1 ft. 3 in. long, 5 in. wide, shelves.

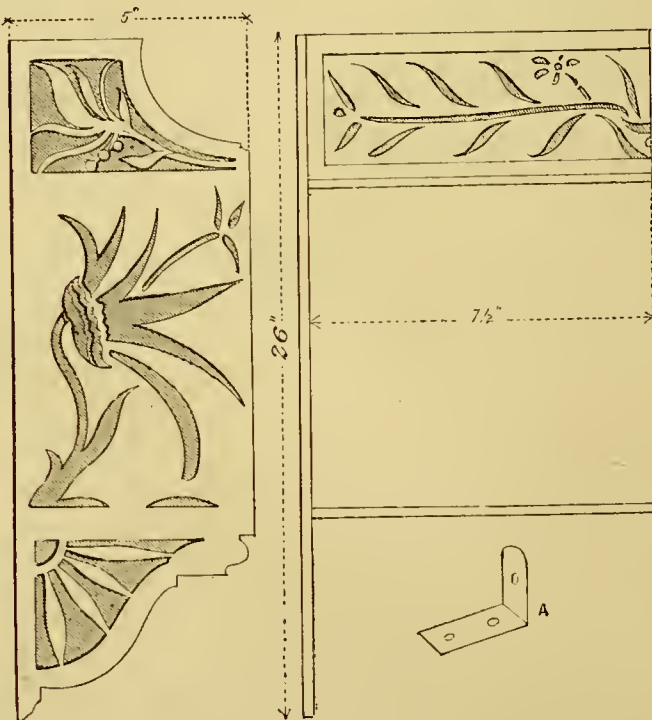
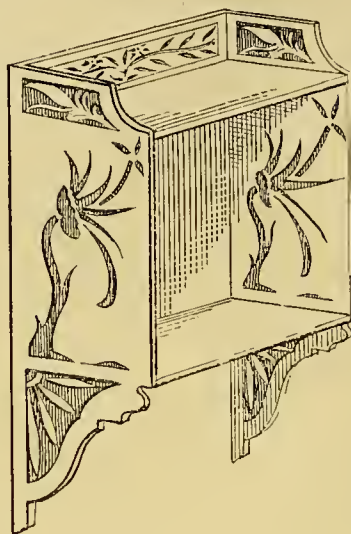
One piece, 1 ft. 3 in. long, 3 in. wide, fret.

The piercing should be carefully done with a fretsaw, the whole being nailed together

as before. The fret on top of shelf has a small strip of stuff, say,  $\frac{3}{8}$  by  $\frac{1}{16}$  inch, glued or tacked round, so as to form a shallow panel.

The best method of hanging up is to cut out of a piece of thin sheet metal, preferably brass, a plate as shown at A, being screwed on by means of a couple of screws, brass-headed nails being used to fasten the whole to the wall or wherever it may require fixing.

Although the dimensions given are for small brackets, the general ideas may be used with advantage for



A FANCY BRACKET. DETAILS ONE-FOURTH FULL SIZE.

are cleaned up, they can be nailed together, not omitting to use a fine bradawl previous to driving

general ideas may be used with advantage for



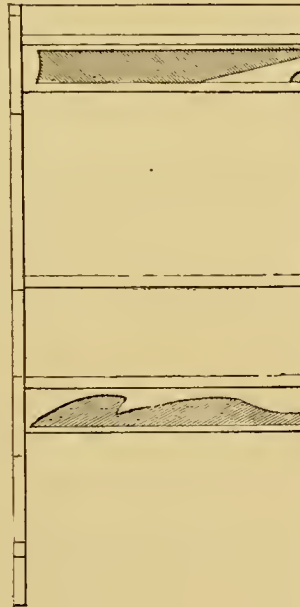
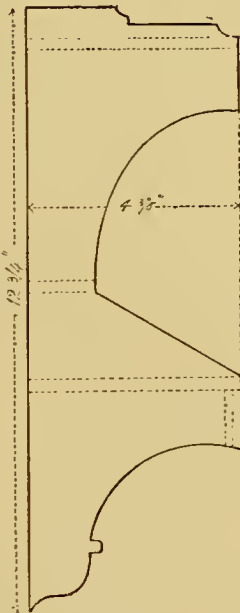
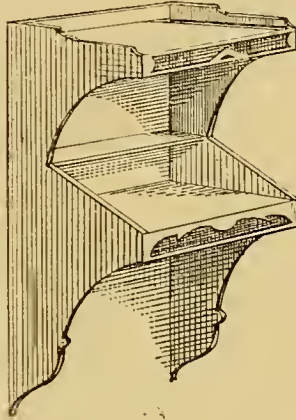
brackets on a larger scale. I do not think that further information is requisite, and therefore leave the reader, trusting that by means of these notes and sketches he may spend a pleasant and useful half hour constructing the brackets thereby described.



A CHARMING EFFECT IN INTERIOR DECORATION may be obtained by the use of silk as a veneering. This may be used as a wall hanging, applied in the same manner as paper, producing an extremely rich effect, particularly where a brocade is used; or it may be combined with satin or other material. In one instance the walls of a large room were made of raised panels of plain wood. Over these panels silk was drawn lightly and smoothly and tacked at the back. The panels of silk were finely decorated with a handsomely designed spray of flowers. Each alternate panel was covered with satin in a similar manner. The same idea is also applied to furniture, and a table top with a silk veneering is very effective. The top of the table is

covered with the silk or satin, which is tightly and carefully drawn over the table so as to present a perfectly smooth surface. The silk is then painted with a flower or figure design, and treated with a number of coats of transparent varnish until the interstices of the material

are entirely filled and it can hardly be distinguished from highly polished wood.—*Builder and Woodworker*.



A FANCY BRACKET. DETAILS ONE-FOURTH FULL SIZE.

HINTS TO LANTERN WORKERS.  
—Mr. W. Jerome Harrison, in *The Magic Lantern Journal*, says:

—"There are two qualities of chlorate of potash at present in the market—a cheap German make, which can be sold at about fourpence per pound; and English-made chlorate, which costs from sevenpence to ninepence. My advice is to eschew the former. Once or twice I have found it of fair quality; but, as a rule, it is cheap and unreliable. Most workers with

oxygen gas are troubled, more or less, by the tendency of the gas to come off in rushes, passing through the purifying bottles so rapidly that it does not get properly washed. I find that the addition of a little dry common salt steadies the flow of gas wonderfully. My present formula is—Chlorate of potash, 1 lb; black oxide of manganese, 4 oz.; common salt, 2 oz."

POLISH FOR TURNERS' WORK.—Dissolve 1 oz. of sand-

arac in half a pint of spirits of wine, shave 1 oz. of beeswax and dissolve it in a sufficient quantity of spirits of turpentine to make it into a paste, add the former mixture to it by degrees; apply, with a woollen cloth, to the work while it is in motion in the lathe, and polish with a soft rag.

## FITTING AND ERECTING.

By A FOREMAN PATTERN-MAKER.

## XIII.—SOLDERING AND BRAZING.



HE wiped joints of the plumbers do not come within the range of engineers' work. The only joints used by engineers in soft soldering are those made with the copper bit, and by sweating. Some of the work done by engineers is simply sweated for a temporary purpose, being held together while certain operations are being performed, and separated afterwards.

Before using the copper bit it is heated to a dull red and quickly cleaned with a file, and is then rubbed upon a piece of sal-ammoniac and dipped into solder, which will adhere to the tool. It is then wiped with tow, and is at once ready for use. The edges of the work to be soldered being first cleaned by scraping, are brought together, and strewn with powdered resin, or with spirits of salts killed with zinc, that is, a bit of zinc is put into hydrochloric acid until the effervescence caused by the chemical action set up ceases. The solder, consisting usually of variable mixtures of tin and lead, ranging from two of lead with one of tin, to one of lead with two of tin, is then melted along the edges in contact, running between them by capillary attraction. The copper bit being drawn along the edges, both warms the work, melts the solder, and spreads it out into a thin and neat film. If the edges are of considerable length it is best to unite them temporarily at intervals with particles of solder at first. With thin work, the spirits of salts is a better flux than the powdered resin; with copper and iron, powdered sal-ammoniac are often used as a flux. The copper bit should not be overheated, for if it is, it will not pick up or distribute the solder, which in that case will be repelled from the bit in the form of globules.

Since one purpose of the copper bit is to heat the work to be soldered, to the temperature of the molten solder, it is not suitable for heavy work. Then the work is united by "sweating," and this method is the more valuable the broader the surfaces to be united. In this method the surfaces are made true, and while still clean

are soldered over, either by rubbing the solder upon the faces already sprinkled with resin, or dusted with sal-ammoniac moistened with water; or by dipping into solder. Then the two faces are heated to a temperature sufficient to melt the solder, and brought into juxtaposition, and gentle pressure, with or without slight rubbing of the surfaces to spread the solder evenly, is exercised, and the work allowed to set under slight pressure. Work of a massive character that cannot be heated by the copper bit, is heated in the clear fire of a smith's forge, or by charcoal. In much work of this kind a good plan is to heat one end of a bar of iron red hot and lay the work upon it, until the required temperature is obtained.

Most work that is soft soldered can be manipulated by the hand or by tongs. But in hard soldering it is generally necessary, owing to the great heat required, to unite the parts to be soldered with binding wire. This is soft iron wire of small gauge bound around to keep the parts from moving out of position. Pounded borax mixed with water is almost invariably used as the flux. It combines readily with nearly all metallic oxides, and so cleans the faces of the metals to be united. Borax contains a large quantity of water of crystallization, and this causes much swelling up to take place, and if the heat is forced it will be sufficient to displace the solder. It is, therefore, a good plan, in some cases, to heat the borax to drive off the water of crystallization, and then powder it and apply with the solder. Or, again, the borax is sometimes first applied to the joint, and when it has fused and become quiet the solder is applied. The solder is applied either as spelter, powdered, or in the form of brass wire wound around the parts to be brazed, which as it melts runs into the joint, the iron binding wire which does not melt, keeping the joint close.

The heat used is either that of a clean smith's or charcoal fire, or in the case of small works, that of a blow-pipe flame. The hard solders used vary with the nature of the metals or alloys to be united. Brass wire is used for uniting iron, but, obviously, it will not do for uniting brass, because the brass would melt at the same

temperature as the wire. Hence the spelters, consisting of various alloys of copper and zinc, are used for soldering brass. The zinc increases the fusibility of the solder; and, further, its volatilization corresponding with the giving off of blue fumes of oxide, is an indication that the process of brazing is complete.

(To be continued.)

## SOME EASILY-MADE SILVER ORNAMENTS.

By "MALLEATOR."



THE directions given in this paper may prove useful to some readers of AMATEUR WORK who may be anxious to acquire a useful employment for long evenings, or to be enabled to manufacture articles suitable for presents. The clasp, which forms the subject of this article, is very simply made, but will be found to repay the worker who carefully follows the directions.

Fig. 1 represents a cloak fastener of an easily wrought pattern; but, of course, should the reader wish to work his own design, he can do so, and yet follow these directions with regard to the actual work; but I give this as a very simple clasp, which looks well when finished.

Fig. 1 shows half of the clasp, one half being furnished with a hook, and the other with a slit or eye. The tongue, *a*, must be left straight when cutting out, to be bent afterwards to form the hook. The clasp may also be made without the hook, etc., in which case it only answers the purpose of ornament, the cloak, etc., being fastened under the clasp with an ordinary large hook and eye.

First procure two pieces of sheet silver: one 4 inches by  $2\frac{1}{2}$  inches, the other  $2\frac{1}{2}$  inches square, or a little larger every way than the design. In case the hook is to form part of the clasp, allowance must be made accordingly. The silver should be No. 24 Birmingham wire gauge, and may be obtained from any friendly silversmith at about 3s. 6d. per ounce; and the waste, or cuttings, should be carefully collected, as they will generally be allowed for afterwards at the above price. It will be well to have the

silver annealed by the silversmith; but this may be done by the worker himself by holding it over a Bunsen burner, or spirit flame, until it assumes a cherry red colour, and then allowing it to cool slowly. Now lay the silver flat, and transfer the design upon it by placing a piece of black carbon paper under the drawing, and then tracing all the lines carefully with a hard pencil point.

The next requisite will be a small block of any hard wood—say, a piece of beech—about six or eight inches long—*i.e.*, in the direction of the grain—and 6 inches square, or in diameter if round, upon the face, which should be cut with a fine saw, in which case it will be sufficiently smooth for the work. This block may, of course, be much larger; but I have given the dimensions which will suit the work in hand. Now lay the silver upon the surface of the block (grain on end), and secure it by punching holes round the edge about an inch apart and tacking down firmly with half-inch tacks (see Fig. 2).

The lines of the design are now to be indented, and we therefore require two or three small punches, which may be had from any dealer in silversmiths' or chasers' tools. In London, Mr. Thos. Gawthorp, of 16, *Long Acre*; and in Dublin, Messrs. Booth Bros., *Stephen Street*, supply all requisites for this class of work.

The tool we first need is a "tracer," the working end of which is represented at *a*, Fig. 3. This punch has a straight edge  $\frac{3}{8}$  inch wide, which is moderately sharp, but very smooth, and with it either straight or curved lines may be indented. Holding this punch in the left hand in a perpendicular position, and using a small hammer, proceed to indent the lines, being careful to follow the design and avoid breaks or irregularities. This process is to be repeated several times, until all the lines are clearly defined. For the sharper curves, and for corners, the tool, *b*, Fig. 3, may be found necessary. The result of these operations will be, that the portions of the silver which are to constitute the clasp, and the surrounding metal, will be bulged up around the lines, while the latter are punched down to the level of the underlying block.



The next step is to punch down the spaces indicated by the dotted background, the effect of which will be to cause the other parts to appear in higher relief than before. This is done by the use of tool *c*, Fig. 3, which is a pointed punch with the point flattened. Care must be taken not to strike too heavily, else the tool may go through the silver—a remark which applies equally to the other punchings. The punching down of the ground should be carried up to the

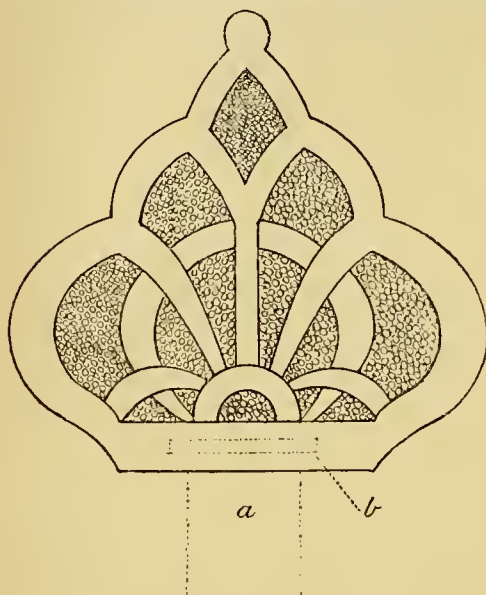


FIG. 1.—HALF OF SILVER CLASP.

indented lines, but must not encroach upon the parts in relief. The markings may be as close together as possible, and the worker should aim at getting the bulged metal down to the level of the block, but not deeper.

When the groundwork of the interstices is all beaten down, the lines of the design may again be gone over lightly to ensure sharpness; and if the silver lying outside the design be also punched down to a distance of about one-eighth of an inch all round, it will serve to increase the relief of the raised parts, and also expedite the after process of cutting out. The tongue, *a*, and slit, *b*, Fig. 1, need not be indented with the tracer.

The silver may now be removed from the block by gently prising the tacks with a small

screw-driver, etc., when it will most likely be found rather curled, or “buckled.” To remove this, fold a cloth, which has been slightly dampened, in four; lay it upon a table, and place

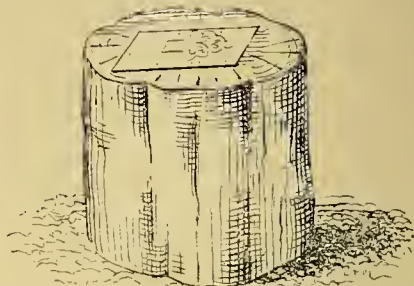


FIG. 2.—SILVER TACKED ON BLOCK AND READY FOR WORKING.

the silver, face down, upon it. Now, with a light hammer, tap it over the back, at the same time pressing the metal down with the fingers of the left hand until it is quite flat. The tapping must not be hard enough to dint the silver, but will be found effective to remove the curl.

The next step is to cut out the clasp, and the best way to do this is with a very fine fretsaw. Cut carefully along the outer line of the design, not forgetting the tongue, *a*, in that half which is to form the *right-hand* portion of the clasp. Smooth the raw edge left by the saw with a fine file and some emery cloth, being careful not to scratch the silver, and then lay the clasp upon a

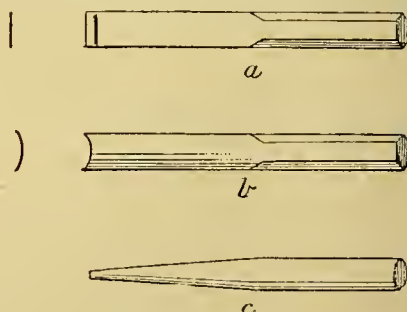


FIG. 3.—TOOLS REQUIRED.—*a*, TRACER; *b*, FOR SHARP CURVES; *c*, PUNCH.

flat surface and polish well with a moderately hard brush (a twopenny nail-brush will suit admirably) with emery flour and oil. Wash in hot water with soap and soda, dry, and polish

with a stiff plate-brush and whiting. Should it be preferred, the groundwork of the clasp may also be cut out with the fretsaw, which will, perhaps, make the article more effective.

I have not given directions for the cutting out of the slit, *b*, or the bending of the tongue, *a*, as these details will suggest themselves to the reader. Several pairs of very small holes should be drilled in, say, three places in each half of the clasp, by which it may be attached with a needle and strong thread to the cloak, etc., for which it is intended.

Various other articles may be made on the same lines as the above, such as monograms for albums, clasps for books, chatelaines, etc., etc., etc.; and to any of my readers who are repoussé workers, it need hardly be said that, whilst this paper suggests a simple method of working, much better results will be obtained by the employment of the ordinary chaser's bowl and pitch cement; and if the worker is skilled in this direction, the articles may be "chased" and modelled, and otherwise much more highly finished. My directions, however, are for the benefit of those who may wish to "try their hand" at the manufacture of simple silver ornaments, but who know nothing of the "orthodox" method of producing them; and should any reader who may be practised in the art be inclined to question the efficiency of the very simple method here suggested, I shall be happy to forward for his inspection a specimen of work executed exactly as directed.

A SINGLE plate of perforated zinc about a foot square, suspended over a gas jet, will retain the noxious emanation from burning gas, which it is well known destroys the binding of books, tarnishes the gilding, and vitiates the atmosphere for breathing.

DAMP WALLS.—According to a German architectural paper, a wash of paraffin-wax dissolved in heavy solvent naphtha in the proportion of one part of paraffin to two and a-half or three parts of naphtha is an excellent preventive of damp in walls. The wax is melted by an application of a little heat, and kept fluid during use by dipping the vessel of wash in warm water.

## HOW TO MAKE AN ORGAN STOOL.

By W. H. YORK.

(For Illustrations, see Folding Sheet issued with this Part.)



TO the readers of AMATEUR WORK, especially those of them who take an active interest in the construction of organs, I think a paper, the subject of which is given as a heading, might prove very acceptable. I specially refer to this section of our readers, because, when they have finished their noble undertaking, and the instrument requires a performer, it might be considered uncomfortable for any musician to play without a stool to sit on. Then, again, it is a consolation to anyone who is possessed of an organ or pianoforte with pedal attachment to know that he can construct a stool to suit his own convenience with regard to height, etc. Another point, and by no means the lesser one—he can save a considerable sum by making one himself rather than purchasing one at a music warehouse or having one made by a joiner. I know of instances where stools procured at a pianoforte manufactory are charged for at a somewhat exorbitant rate. Anyone with a moderate idea of joinery can easily make any of the stools I am about to describe, and I think there will be designs to suit all tastes.

It must be noticed in the following remarks that the height given for all the stools from the ground is 2 feet 2 inches. This is a most comfortable height, supposing that the bottom of the legs rest on a level with the bottom of the pedals, and the pedals not more than 5 inches from the ground. No definite length can be given for the top, as pedal boards vary so much. In setting out a stool allow the inside measurement between the legs to be  $1\frac{1}{2}$  inches more than the outside width of the pedal board.

The most simple way to make a stool is to get two pieces of  $1\frac{1}{2}$  inch deal, 2 feet  $2\frac{1}{2}$  inches long and  $10\frac{1}{2}$  inches wide, and cut two tenons on the top end, 2 inches wide, and let them through  $1\frac{1}{2}$  inch top, gluing and wedging them from the top side. On the insides of the legs, under the top, glue and screw two 2 inch blocks,  $10\frac{1}{2}$  inches long, with two screws into the leg and two into the top. This, of course, constitutes a very

plain piece of workmanship, but it may suit some. I thought it unnecessary to give any drawings for this.

In looking at Fig. 1, the end leg of a somewhat plain stool will be noticed. This will be most useful to those who wish to keep music and books near to the organ, as the top forms a lid to a box, 5 inches deep,  $8\frac{1}{2}$  inches wide, and a good length. This bench may be made of  $1\frac{1}{2}$  inch pitchpine, walnut, or pine stained rather dark.

First of all, get two pieces of nice straight  $1\frac{1}{2}$  inch stuff, 2 feet  $\frac{1}{2}$  inch long,  $10\frac{1}{2}$  inches wide (finished); plane them up quite true, and make the top and bottom ends nice and square. At 6 inches from the bottom end, in the middle of each leg, cut a mortise 2 inches long and 1 inch wide, to admit the end of a tie-rail, described later on. (If the pedals are higher than 5 inches from the ground, this mortise will have to be cut so much higher.) Cut out the bottom end like the end of the drawing. This might be simply a semi-circle, as in Fig. 3, if preferred. Mark on each edge a line 6 inches from the top and 5 inches from the bottom. This will represent the outside of each hollow. With a bow-saw cut a piece  $1\frac{1}{2}$  inches wide out of each edge. On the top ends of each edge cut out a slip 5 inches long and  $\frac{1}{2}$  inch thick. Prepare, now, two long strips, 5 inches wide (finished), 1 inch thick, to hold the legs together at the top and form sides for the box. Cut them  $7\frac{1}{2}$  inches longer than the inside measurement between the legs. The ends will be shaped like *a*. At 6 inches from each end cut across the stuff a groove 5 inches long, the width of the thickness of the legs and bare half inch deep. In making this groove, gauge half inch from the outside of the piece, and from the inside cut out the remainder; care must be taken so that when the legs fit into this groove they shall fit tight. Now get out a piece of  $1\frac{1}{2}$  inch stuff, 2 inches wide (finished), and cut a tenon on each end 1 inch thick, 2 inches wide, and 3 inches long. The length from shoulder to shoulder will be the distance between the legs. Stop-chamfer the four edges a  $\frac{1}{4}$  inch on each edge, and start to bevel to meet the flat place at 1 inch from the end. Through the tenon cut

a mortise  $\frac{3}{8}$  inch wide,  $\frac{5}{8}$  inch long on the top side, and  $\frac{1}{2}$  inch on the bottom, at  $1\frac{3}{8}$  inches from the shoulders. Through this a piece of birch or oak will be driven, shaped like *b*; this is 3 inches long,  $\frac{3}{4}$  inch wide at one end,  $\frac{1}{2}$  inch wide at the other, and  $\frac{3}{8}$  inch thick; *c* is the end of the rail just described, half the actual size.

Now fit the tenons into the legs and fasten them there with the keys, and put on the front and back top rails. The groove that has been cut in the rails should fit tight on to the part of the leg that has been left when the half inch was cut out at first. The rails will be fixed here with three  $1\frac{1}{4}$  inch nails and some glue to each leg, taking care that the leg is square with the rail. Fit a piece of half inch stuff between the legs on the underside of the top rails, so as to form a bottom for the box. Bevel each edge  $\frac{3}{8}$  of an in. down to nothing. This will take off the projection, which would otherwise show. Fasten it to the top rails with a few inch nails. Lastly comes the top. This is to be  $10\frac{1}{2}$  inches wide,  $1\frac{1}{2}$  inches thick, and 2 inches longer than the top rails. The four corners will be rounded, and all the top edges will be planed with a hollow all the way round. When this is done it will be fastened to the top back rail with a hinge fixed 8 inches from each end. A lock may be put on in front, if desirable. The whole will be varnished by way of a finishing touch, and when finished, the whole will present as useful a seat as one might wish for without being unnecessarily clumsy.

Fig. 2 is a design for a stool end, which should be made out of 2 inch oak. This looks an elaborate affair when finished and left in the plain wood. The chief difficulty is the shaping of the edges. In this the top will be  $1\frac{1}{2}$  inch oak, with the corners cut off  $1\frac{1}{2}$  inches from each side and end. To make it into a seat that would be an ornament to anybody's music room, the top would be made of yellow deal, and upholstered in dark green leather; this, of course, would be expensive. If this is not done, the top edges will be bevelled all the way round, so as to show a flat place half inch wide.

There will be no tie-rail, but a piece will be shaped like *d*. This will have a tenon on the end, 1 inch thick,  $1\frac{1}{2}$  inches long, and 3 inches



wide. Fit this into a mortise in each leg the same size. The top end of this will be  $2\frac{1}{2}$  inches from the top end of the leg. The tenon will be glued, and the other end will be fastened to the underside of the top by a screw from the narrow point. Two tenons, 2 inches wide, will be cut on each leg, and fixed into two mortises in the top and wedged from the top. The corners will be chamfered all the way round, so as to show a good half inch flat place. The edges of the legs will also be served in this way.

Fig. 3 is a design to be made out of  $1\frac{1}{2}$  inch pitchpine. This will be  $13\frac{1}{2}$  inches at the bottom and 9 inches at the top. Each end will have two tenons, fastened like those in Fig. 2; the top,  $1\frac{1}{2}$  inches thick, will be shaped like that of Fig. 1, and will have a tie-rail exactly like the one in the same drawing.

Fig. 4 is the end of a stool with turned legs as a substitute for the shaped end. The legs will be turned out of  $2\frac{1}{2}$  inch pitchpine. In the part that is left square on each leg a mortise will be cut on two sides,  $2\frac{1}{4}$  inches long,  $\frac{3}{8}$  inch wide, and  $1\frac{1}{2}$  inches deep, which mortise will start at an inch from the top end. The end and front and back rails will finish  $3\frac{1}{4}$  inches wide and  $1\frac{1}{4}$  inches thick, and will have a tenon cut at each end,  $2\frac{1}{4}$  inches wide,  $1\frac{1}{2}$  inches long, and  $\frac{3}{8}$  inch thick. The top will be  $1\frac{1}{4}$  inches thick, 12 inches wide, and rounded at the corners and edges on the top side. It may either be fastened to the top rails with screws put in in a slanting direction through the top rails into the top from the inside, or blocks may be glued on in the angle formed by the inside of the top and the top rails. In each of the front, back, and end corners a piece will be cut like r, and glued in after the stool has been glued together; and on the bottom edge of the long rails a piece like n will be fastened exactly in the middle. These pieces will be  $1\frac{1}{4}$  inches thick.

When the whole is varnished, it will represent a somewhat more ornamental style of stool than what is generally met with; but to those who do not possess a lathe, the turning of the legs will be an item of expense.

I think a pretty clear idea has been given with regard to the construction of each one of

these seats; but if anyone is in the dark about the making of any part, I shall be glad to answer any questions through the inquiry column.

## PORTABLE HARMONIUM BUILDING.

By ERNEST A. SANDERSON.

VII.—FRENCH POLISHING: REQUISITES—METHOD OF PROCEDURE—GRAINING: TOOLS AND MATERIALS—PAINTING—PLAIN AND KNOTTED WALNUT—VARNISHING.



THE newly-made picture-frame looks bare without its gilt, so does our harmonium now appear as it stands before us, lacking that finishing touch which, if applied with the addition of a little "elbow grease," will convert this solidly-built but naturally dull-looking instrument into a tasteful, if not, in the strict sense of the term, a handsome piece of furniture. The finishing touch is given by the process of French polishing, which will be all that is necessary if the exterior woodwork of the harmonium is constructed of walnut or other choice wood. I may mention, however, in passing, that if the amateur considers himself capable of veneering the most prominent parts of the instrument, it would decidedly be to his advantage and credit to do so; but, on the other hand, I strongly advise him not to venture with such difficult and costly work unless he has practically proved his ability in this direction by previous successful experience. But should the tyro have adopted my suggestion of employing deal instead of the more expensive woods, the work will require to be grained—a more elaborate process than the former, and which will be fully described later on in this chapter.

The method of French polishing is not by any means a difficult one; it only requires careful treatment and regularity of working, combined with a moderate amount of patience on the part of the worker. The job should be commenced easily and steadily—having everything ready to hand, and avoiding all flurrying and bustling about, but increasing the energy as the work advances. Moreover, as practice

makes perfect, the novice would do well to try his hand at polishing a few odd pieces of wood (preferably those saved from the wood employed in constructing the harmonium or its case), before starting on the job in hand.

The materials required comprise orange polish (perhaps better known at the oil shops as *French* polish, of which half a pint, costing 6d, will be plenty for present use), linseed oil, methylated spirits, brown (walnut) stain, plaster of Paris, and some clean white rag and wadding. The question which now naturally follows is how they are to be used, and I feel convinced that the following directions will enable the veriest novice to perform the work with happy results.

As most new woods are very porous, it is advisable that our first operation should be what is called the "filling in" of the wood that is to be polished, which is done in the following manner. Mix some plaster of Paris with water or oil into the consistency of thin paste, colouring the mixture with the brown stain to correspond with the wood, to which it must be applied with rag and well rubbed in. If, however, parts of the woodwork differ in shade, the light parts should be previously darkened with the stain to match the other, thus securing a uniform colour throughout. When the plaster has become dry, rub down the woodwork with fine glass-paper, being careful to work with, and not to cross, the grain of the wood, or unsightly scratches will mar the otherwise smooth surface. The surplus plaster having been cleaned off, and an even surface obtained, the work should be "bodied in" by receiving two applications of polish, then left for some twenty-four hours to dry, and afterwards well rubbed down with glass-paper.

To make the "rubber" or pad with which the polish is applied, take a piece of wadding, large enough to hold comfortably in the hand when pressed hard together, and pour upon it some polish from a bottle. Cover the wadding with a piece of clean, non-fluffy white rag, which should be moistened with a few drops of oil, and twist its ends underneath the pad thus formed. By this means the polish will work

freely, and be prevented from sticking to the wood in patches.

One, or rather two, of the secrets of success in the art of polishing, is that the hand should describe a series of overlapping circles; and the other point which I must impress upon the novice, is that he must make up his mind before starting to stick well to his work, and not be afraid to give the muscles of his arms a thorough good exercise. Again, whenever he wishes to discontinue the rubbing process for the purpose of putting more polish on the wadding, he must not stop abruptly in the middle of a panel, but glide off to the edge; then, having applied the polish and oil to the wadding and outer rag respectively, continue working in the same manner as hitherto. When the whole of the job has been once gone over, repeat the process many times, allowing each application to harden before another is applied, until there is sufficient polish on the work. This may be ascertained by noticing whether any dull spots appear on the polished surface; if there are, go over the work again until none whatever can be seen. Take care to shift the wadding to another part of the rag after each application, otherwise the latter will most likely rub into holes.

Our next thought must be to "spirit off" the work, *i.e.*, to remove from the polish the greasy appearance caused by the oil.

Upon a new pad (made with clean rag and wadding) pour a little methylated spirits, and with very slight pressure, work the hand briskly backwards and forwards upon the surface in straight lines—*not* in circles as previously. If, during this process, the rubber should cling to the polish, it may be eased by gently breathing upon the face of the work.

*Painting and Graining.*—As I have already mentioned in a previous chapter, it is my purpose to conclude this series of articles on "Portable Harmonium Building" with a description of the way to imitate the graining of *walnut* wood, because, generally speaking, that wood has the most suitable appearance for an harmonium. But should any reader wish for other methods of graining, I shall be most glad to be of use to him at any future time, or he



will find valuable information on this subject in Chapters V., VI., and VII., of Mr. Edwinson's papers on "House Painting and Papering," which appeared in Vol. III. (Old Series) of *AMATEUR WORK*.

The preliminary step of well glass-papering the wood-work having been done, give any knots

couple of days to harden before proceeding with the painting. The first coat of "priming" colour consists of white-lead, red-lead, driers, linseed oil, and turps, of which the following quantities will probably make up sufficient colour to cover both the harmonium and the box: namely, 2 lbs.

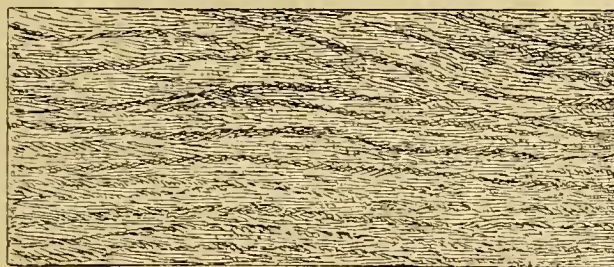


FIG. 38.—PLAIN WALNUT GRAINING.

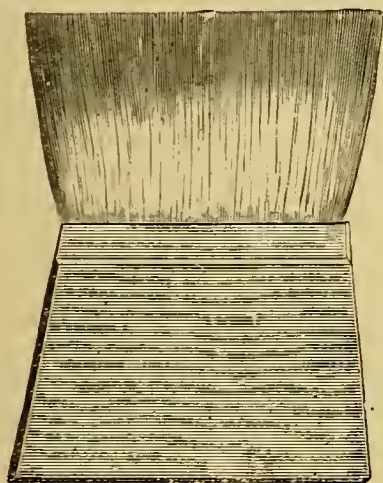


FIG. 35.—MOTTLER.

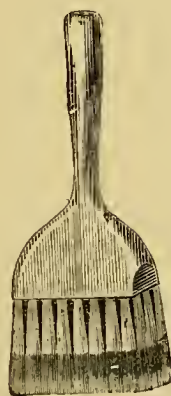


FIG. 36.—BADGER SOFTENER.

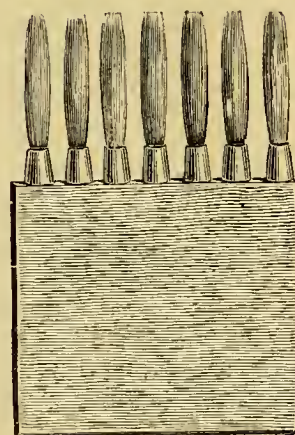


FIG. 37.—PENCIL OVER-GRAINER.

there may be in the wood one or two coats of Patent Knotting, or better still, a coating or two of gold size and red-lead, mixed together in such proportions as will make a thick paste. The object of this treatment is to keep the knots firmly in position and to prevent the gum or turpentine from oozing through the wood, as it most probably would in very warm weather were not this precaution taken. Leave this for a

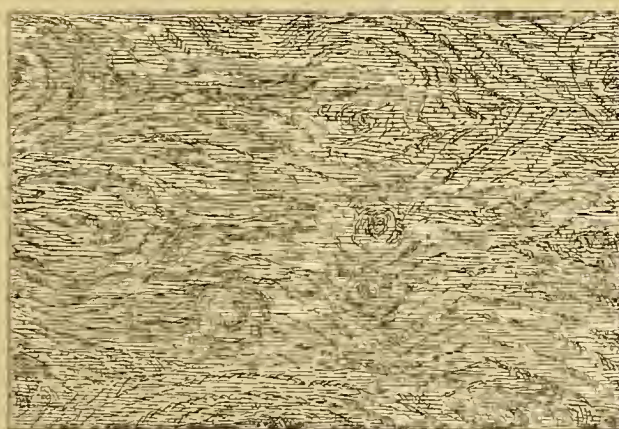


FIG. 39.—KNOTTED WALNUT GRAINING.

of white-lead,  $\frac{1}{4}$  lb. of driers, 1 oz. red-lead,  $\frac{1}{4}$  pint of linseed oil, and the same quantity of turps. Well mix these ingredients together in a paint kettle, and then strain the paint through a piece of muslin. As every subsequent preparation of colour will require purifying, it

will undoubtedly be advantageous to the tyro to have the precise method of straining explained in detail. Stretch the muslin rather loosely



across an empty paint-pot, and secure it in that position with string; then gently pour the colour on to the muslin, stirring it meanwhile with the paint tool, when the liquid will strain through, free of all the grit and skin, which remain on the muslin.

The colour now being ready for use, give the woodwork a coat with a good-sized brush, and allow it to stand until dry; then well rub down the job with glass-paper before the next coat of paint goes on. This second coat is the same as the previous one (with the exception that red-lead is not required), and like it, must also be cleaned up with glass-paper when dry. Be careful to avoid having the colour too thick, or else it will not work freely, besides spoiling the effect of the graining by producing a rough, liny appearance. However, the addition of a little turps and oil will thin the paint to the required consistency.

The ground colour—so called because it is supposed to be the foundation colour of the wood that we wish to represent, in this case walnut—must be of a reddish-buff tint. This is produced by adding  $\frac{1}{4}$  lb. of yellow ochre and half that amount of Venetian red (ground in oil) to the quantities of white-lead, driers, oil, and turps already stated. After being well strained, apply the colour with a pound brush, and to ensure a smooth solid surface being obtained, it will be best to give the job two thin coats instead of one thick one. The paint must be carefully rubbed down with glass-paper when dry, as heretofore, and finally wiped to remove every particle of dust from the work. Then mix in the work: that is, with a sponge, rub a little whiting and water over the parts to be grained, in order that the water-colour may adhere to and cover the oil-paint evenly. The graining colour consists of equal quantities of burnt umber and Vandyke brown mixed in water (not beer, as often recommended) to the required tint, according to the worker's fancy.

The foregoing work has been easy enough, for with the instructions given, failure was almost a matter of impossibility; but we have now arrived at that stage wherein artistic skill must be displayed. In other words, the amateur

has got to imitate (to what extent of perfection it depends now entirely upon himself—or rather his ability) the natural grain of walnut-wood; hence, experience in the use of the brush, and an eye for good general effect are indispensable acquisitions. In Figs. 38 and 39 I give specimens of two different kinds of walnut graining, distinguished as *plain* and *knotted*. The former method is by far the easiest of the two, but, of course, one does not expect it to look so fanciful or so ornamental as the other. Nevertheless, it possesses a far more genuine appearance if skilfully contrived than the latter (no matter how well done) is likely to present.

The novice must go to nature for his designs. He will find good examples of plain graining in the walnut-wood employed in the construction of wardrobes and ordinary harmoniums; whilst the veneers on pianos, cabinets, etc., will provide him with excellent patterns of knotted graining. I might fill best part of the present number of this Magazine with instructions of the *modus operandi* of graining, but as it would be of little use to the beginner (who will find it of much more practical service to get a friendly grainer to give him a lesson or two), I shall not attempt to raise the ire of our worthy Editor by flooding him with such useless manuscript. Therefore, I give the following hints merely to afford the novice an insight into the mode of procedure generally adopted.

Apply the graining colour with the mottler (the short brush shown in Fig. 35) on a small portion of the work at a time, and while still wet, remove streaks of the paint by gently drawing the badger softener (see Fig. 36) over the work, thus exposing streaks of the lighter ground colour beneath. After having immediately blended and softened down the paint the reverse way, improve defective places, and finally touch up the whole with a deeper tint. This process, which is admirably adapted to the beginner, will produce the veinings of plain walnut similar to that illustrated in Fig. 38. But to imitate the patterns of knotted walnut is, as I have said, a much more difficult process, and requires the assistance of the tool shown in Fig. 37, termed a pencil over-grainer.

The design having been sketched in, the over-graining colour, composed of burnt umber and drop black, is applied in varying degrees of shade to coincide with the design—the tint deepening and strengthening as the knots are approached. When this is dry, bring into more prominence the supposed graining of the wood with a darker tint applied with the over-grainer; and then subdue and blend the whole with the softener, but without producing a smearing effect.

A superior finished appearance may be obtained by putting in the beads of the instrument and box about three shades darker than the rest of the work. The next, and final, operation is that of *varnishing*.

Best carriage varnish is most suited for this work, since it has a better gloss and is more durable than any other. It is applied lightly in straight, even strokes with a comfortably large brush—care being taken not to rub up the colour beneath—and the first coat is allowed to harden before proceeding. Then carefully rub down the work with water and pumice powder sprinkled upon a piece of felt until the varnish becomes quite dull, and afterwards rinse well with clean water. By this means, any defect in the first application of varnish is amended, whilst the second coat is caused to look more like polish than varnish.

Now that our harmonium is finished, I must take my leave of those amateur friends who have been interested in the welfare of these papers, with the sincere wish that their little portable instrument will give as much satisfaction and enjoyment to them (and prove as valuable into the bargain) as my brother obtained from his. So, whilst the loyal, if not soul-inspiring, strain of the National Anthem fills the air, the curtain falls.

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A SUSPECTED JOINT in a sewer or drain-pipe may be tested by wrapping it with a single layer of white muslin, moistened with a solution of acetate of lead. As the gas escapes through the meshes of the cloth, it will be blackened by the sulphur compounds,

## SAFETY BICYCLE CONSTRUCTION FOR AMATEUR MECHANICS.

By A. STEVENSON.

### VIII.—THE DRIVING CHAIN—TRUING THE WHEELS—FIXING TIRES—ENAMELLING.



SAFETY BICYCLES of the type here treated, are driven by the use of a chain, gearing upon cogwheels. The chain is, therefore, a most important factor in the construction, and the machine must be so constructed that a means of adjusting this chain is readily afforded. About the best chain at present in the market for these machines is known as the "Abingdon Humber," 1 inch pitch, and, of course, the hub cog and the chain wheel on the pedal shaft must be of the same pitch. It takes about 4 feet of chain for one machine, and when bought, it has a small screw-pin through the endmost links for joining it on the wheels. In placing a chain upon the wheels, the back wheel-pin or shaft is slipped in as far as it will go in the slotted ends of the fork, see Fig. 44, A, then the chain being put round the two wheels and the ends overlapped, will show at once if any links have to be cut away by filing the rivet. When the chain is cut to length, and the joining screw put in, it will hang somewhat loosely, being half a link or a whole link too long. To pull the driving wheel backwards in the slot would tighten it, but this would be insufficient, as the slightest loosening of the outside nuts would allow it to slide in again, thus slackening the chain, consequently an adjustment that will remain so is required. Various methods are adopted; the method here shown, Figs. 44 and 45, is different from any I have seen, is simple, and thoroughly effective. The two figures, which are drawn full size, will, I think, almost speak for themselves, a lug, B, is cast on, or made solid with each of the slotted fork ends.

These lugs are each bored a  $\frac{5}{16}$  plain hole, the holes being exactly in line with the centre of the slots, as shown. Then two pins of the form, Fig. 46, *a, b*, are made, the shanks to pass freely through the holes in the lugs. The broad ends of these pins are bored to fit the axle pins of the hub, and lie flat against the fork sides on

the outside, Fig. 45. The shanks of the pins are screwed in their whole length and two nuts put on each, one on either side the lug, *b*, as shown. Now it will be evident that as these two pins carry the driving wheel shaft backwards and forwards in the slot the wheel and the tension of the chain may be adjusted to a nicety by the nuts on either side the lug, *b*, the whole length of the slots (about 2 inches) being available to take up any slackening by wear of the chain. The wheel by means of these screw-pins can at the same time be adjusted to run exactly in the centre of the fork. It is to be observed that the chain should not be made quite tight in adjusting, but should hang loose just a little, the under half showing a slight curve or bag downwards, when the upper, or pulling, side is quite tight, as when the machine is being ridden. When the chain is thus at the proper tension and the wheel running in the middle of the fork, then the axle nuts, *d*, are screwed up tightly.

I have now described every part of the machine proper, the remaining necessities being accessories, such as spring, saddle, pedals, etc.

We will, having finished our frame, go back to the two wheels, which we left still without their final truing and minus their rubber tires. We now take them up.

The proper way to go about a job of this sort is to make and finish the frame, as described, ready for the wheels, then to take the two hubs and fit them in the forks, as also described, so that when the wheels are built on the fitted hubs, there is no after-fitting or any difficulty whatever in placing the wheels in their respective forks. Now take, say, the front wheel, place it in the fork and screw up the nuts, if the wheel has been properly dished, that is, having the same projection of hub on both sides, then the rim of the wheel will run in the middle of the *center* of the fork and right under the spoon brake; if it inclines to one side, take it out and reverse it, as perhaps the fork may be at fault; if it runs as much off the centre on the opposite side, then the wheel is at fault, one side of the hub projects more than the other, in other words, one side of the wheel is flatter than the other. Now, you have got to screw back, or loosen all the spokes on the

*flat* side, and tighten up all the spokes to the same degree (say, half a turn) on the high side, put the wheel in place again, it may now run in the centre of the fork, but wobble unpleasantly, it wants truing. Have the fork firmly fixed in a vice, spin the wheel round, hold a piece of chalk to the side of the rim, the chalk will mark it wherever it is off the truth; hold the chalk in the same manner to the other side of rim. It will now be found that the chalk marks on one side are not opposite those on the other. Now, with the spoke-grip, slacken a spoke where the chalk mark is heaviest, or if it is equally heavy opposite, say, three spokes, slacken all three a little and tighten up three on the opposite side, go round the wheel, treating all the chalk marks in this way, when a visible improvement will have taken place; clean off all the chalk marks and chalk again, loosening and tightening as before. These details are only for those who are beginners at truing wheels, as it takes some experience to build and train wheels smartly. I have often put up wheels that ran perfectly true at once, using only the slip of wood before described, for a gauge.

Now the back or driving wheel is a little more troublesome, as the hub is an irregular body, having the chain-cog on one end of it, and, consequently, the flanges for the spokes not equidistant from the fork sides. In this case the wheel has to be built with more dish on the one side than the other, in order that the rim may run in the centre of the fork at the outer. If, when tried in its place, it does not run satisfactorily, it can be put right by the same process as described for the front wheel. Both wheels being trued, we now put on our rubber tires. Rubber tires are of various qualities, they may be bought from 2s. 6d. to 7s. 6d. per pound; fairly good tires can be got at 3s. 6d. to 4s. They are either plane or fluted in section. A section of a fluted tire is shown, Fig. 47. The inner side, that which is inserted in the hollow rim, has the narrow flutes, which are a series of narrow grooves which serve to make the cement take a better hold. The larger flutes, usually four, are on the outside of the tire, and are intended to prevent slipping sideways on a slippery causeway. Tires



can be bought to suit the circumference of the wheel as also the section. The cement is bought at about a shilling a pound and has got to be melted in an iron pot, then a small ladle or a

little at every part as it is being put into the hollow, as it would not do to do all the stretching on the portion that is last put in, as the tire would then have a thin side; care must be taken, also, to place the rubber so as to have the flutings even with the rim all round, as otherwise it would look very

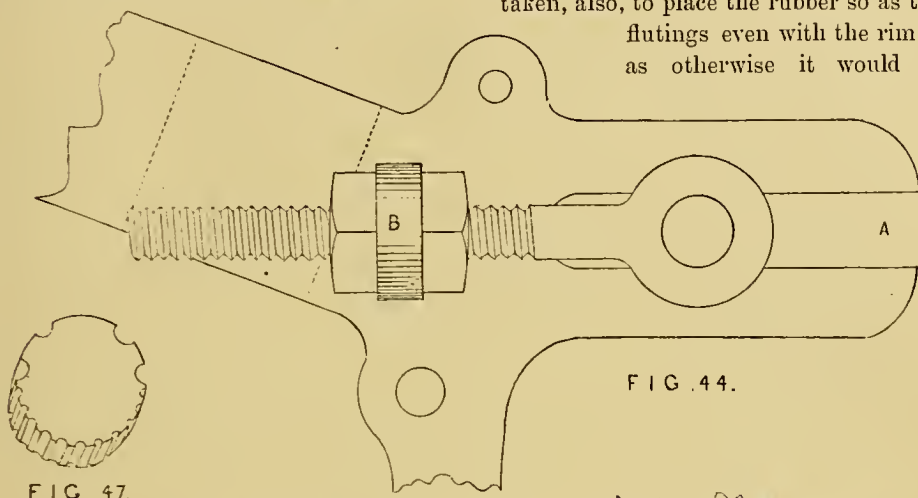


FIG. 44.

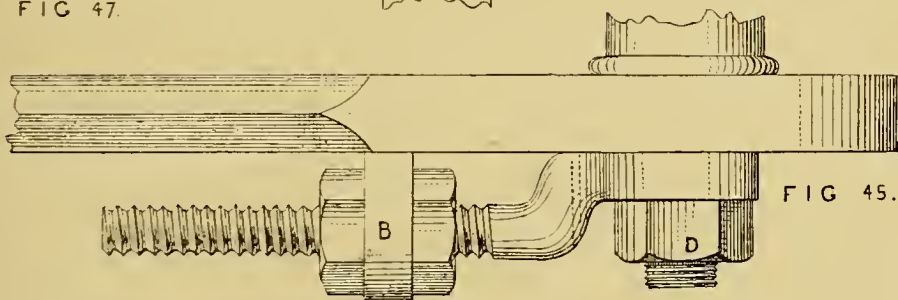


FIG. 45.

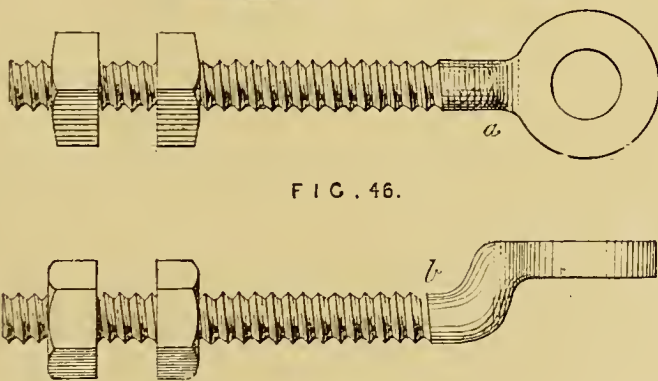


FIG. 46.

large spoon is used to pour it all round the rim of the wheel, previously to this the rim should be made perfectly clean from oil or grease, then over a forge fire the rim should be heated by turning it round over the

fire till the whole rim feels quite warm, the hot cement poured into the hollow rim will flow evenly all round, then the rubber is placed in the hollow. If the rubber is a tight fit circumferentially for the rim, it should be pulled a

unsightly; this has to be watched particularly in the re-heating, for the rim has to be re-heated over a gas or other flame, thereby re-melting the cement. When you can roll the rubber sideways in the rim, causing the

cement to appear at the edges, then it is right, and this re-heating is continued all round the rim, heating 5 or 6 inches at a time; any superfluous cement can be cleaned off when it has cooled. So much for the wheel tires. The

foot-rests have each to be clothed with a rubber, but these are kept off until the painting, japanning, or enamelling of the frame is completed.

To prepare the frame for enamelling or japanning, the whole of it should be filed and fine filed, unless such tubes have a smooth, clean surface, but wherever any roughness or scaliness appears, it should be removed by fine filing and rubbing down with emery cloth without oil. The whole surface to be coated should be cleaned of all oil, grease or dirt. If the machine is to be stove enamelled, it will have to be sent out to an enameller, who will finish either with or without lines. Japanning is not so good a job as enamelling, but is much cheaper, and may be done by the amateur with little trouble. I use black japan, sold at 2s. 6d. per pound.

I undo the machine into as many separate parts as possible, and in a warm room, before a good fire, I heat each part fairly warm and give a coat of japan with a brush; the japan will flow readily by reason of the heating. All the parts, being coated, are hung up in the warm room for a day. When dry, I rub them smartly with a cloth and give another coat, heating as before. When this is dry there is too much glitter, a careful rubbing with a chamois leather will give it the appearance of a real stove enamel, and while it is not by any means so durable, yet it is a good, cheap job, and it may be renewed by another coat after a few months' use.

Now, as to the plated parts, you may get the whole of these plated, handle bar, brakework, hubs, L pin, cranks, bearings, nuts, etc., for 7s. or 8s., or you may pay treble that sum, according to the quality of the plating. The better kinds of plating have a deposit of copper under the nickel, and are, therefore, much more durable.

Now, having got your machine this length, you are about ready for the road, the only accessories not yet noted being a spring, a saddle, and pedals. These may be bought of various qualities, to suit the purse of the buyer: springs ranging from 2s. 6d. to 16s.; long-distance saddles from 8s. to 15s.; and pedals, plated, from 5s. to 14s., the former being plain pin, and the latter ball, pedals.

*(To be continued.)*

## FITTING UP A WORKSHOP.

By REV. ALGERNON THOROLD.

### IV.—PROVING TOOLS—HINTS FOR THE WORKSHOP.

**R**ESUMING that we are now set up with a shop and its first inward and outward accessories as we may best be pleased to consider them, also that we have plenty of light and warmth, our next consideration must, undoubtedly, be our more inward appointments, such as the bench, tools, and materials.

In setting or fitting up a shop we have to consider, in the first place, of what sort our future work is likely to be, whether mere rough carpentering or more accurate joinery, with the yet more delicate cabinetmakers' arts. Whatever work it is to which we purpose devoting our attention, there are one or two laws which may be looked upon as being taken from the code of the Medes and Persians, which altereth not, and ought to be held as inviolable by the amateur workman. Beware of cheap tools; beware of second-hand tools; beware of buying tools for which you have no use.

Beware of cheap tools; there is no greater delusion. The best steel of which they are said to be made is not steel at all, but soft iron, upon which no stone or hone will ever produce a proper working edge. The screw-drivers bend, the saws bend, and there is not one sold but what is a snare for the unwary amateur and a certain disappointment.

Beware of second-hand tools. An old hand may not go far wrong in making such purchases, but in nine cases out of ten the bargain-hunting amateur is sure to lose over his investment, and quickly will put aside his purchase in disgust.

Beware of buying tools for which you have no use. This is a great temptation, and a very costly one. Be sure what you want, and buy nothing else. Do not think that because you have a large selection your shop is necessarily complete, or that a variety is needful to insure good work. Nothing of the sort: the more clever the hand, the fewer are the tools required; while a blunderer will ruin his materials as

surely, with all sorts of tools to choose from, as though he had but one of a kind.

There are, of course, certain tools with which we cannot dispense. The following list will be found sufficient for all plain work: A strong joiner's hammer, also another of the same kind about half the weight; a large, strong, square-headed mallet; a hatchet, two wood-rasps, one coarse the other fine; a ripping-out saw, a finer hand-saw, a tenon saw, a jack plane, a smoothing plane, a draw-knife, a spokeshave, two firmer chisels, two gouges, a strong cold chisel, two bradawls, two gimlets, a socket iron brace and half-a-dozen bits; one pair of pincers, one pair of flat pliers, one pair of cutting nippers, a screw-wrench or spanner, a line and reel, a large iron square, a small square for the bench, a folding two-foot rule, a marking gauge, a spirit level, a pair of compasses, a medium-sized joiner's cramp, a large glue-pot, an oil-can, two screw-drivers, an oil-stone in a box, a strong flat file, a punch, a claw-wrench, a trestle or sawing stool.

If we intend, however, to undertake more than mere mending work and very plain joinery, we must make the following few additions to the above list: Two mortising chisels, three more firmer chisels of different sizes, a mortise gauge, a plough, a rebate plane, an auger, a bevel, a fine tenon saw, two pairs of wooden cramps, a half-round file, a three-cornered file, an Archimedian stock and drills, a soldering iron, a bottle of killed spirits, half a pound of solder, a good-sized grindstone with treadle, and a vice.

With these we shall be thoroughly well set up, and supplied with all the tools we can need for any work which we are at all likely to undertake.

Another golden rule which every amateur ought to observe carefully, is, on no account to leave his tools about. If he cannot afford to purchase a carpenter's chest, he should either provide himself with such a cupboard as I described in a former paper, or, at least, with a plain deal box. In whatever receptacle, however, he determines to keep them, a strong lock to it is a *sine qua non*. Tools have a marvellous knack of leaving the shop, and when once they

have escaped their owner's eye, their return is problematic and their destruction certain. Of course, when constant work is being carried on, it is neither convenient nor possible to put everything away each time we shut up shop. The above rule is more for slack times; but for everyday care a strong rack fastened upon the wall will sufficiently ensure the safety of bradawls and kindred tools.

Another hint may be given respecting our tools while in actual use. They have, as we must all have found, a knack of getting rather thick upon the bench, lying one on the top of the other, thus putting each other out of sight. Our saws are special offenders in this respect, and have a very bad habit, besides, of catching our hands or sleeves when put carelessly down. It is a bad plan ever to put hand saws upon the bench at all when not in use. Remember, then, always to hang them up directly after use upon nails, which should be provided upon the wall of our shop for this purpose. It seems quicker to pitch our tools down anywhere after using them than to hang the saw in its place or restore the tool only used sometimes to its shelf. But a little experience shows that the neglect of system is the very reverse of wisdom, and leads to endless searches after straying tools, loss of temper, and eventual loss of time. A place for everything, and everything in its place, is a most excellent motto for all persons and for all seasons, and might with advantage be painted in large letters in every shop and hung in full view of all who come in.

A still further point to be remembered is on no account to have more tools out than we require, and, as far as possible, to make up our minds what we need before we set to work. If we select carefully what we are likely to want before we commence operations, our bench cannot become inconveniently full; and when we find—as, of course, is probable—that we have selected the wrong tools, we ought always to put away those we find unsuitable at the time we bring out the others.

Such rules may appear, as we read them, elementary, and even unnecessary; but the important things in life are just those which



people fail to observe, as a rule, because no one takes the trouble to point them out on the supposition that because of their simplicity they are already well known. Everything is possible to the man who observes and masters details. The plan of attempting to run before we can walk is not more likely to succeed in the workshop than in any other department of life; but if we make it a point to follow the primary rules of tidiness and thoroughness at the bench, we shall quickly find that our work will show its sterling value.

The picture of the artist in his studio, to which our attention was called on the first page of this article, invited us to look at a scene of order, cleanliness, and beauty. But order and cleanliness in the painter's studio are really no more essential there than in the carpenter's shop. If we find them in the studio we are sure that its owner is a master hand, and if they are lacking in the carpenter's shop we may be certain that the work which is done there will be to match.

No artist could work at ease, with pleasure to himself or to others, were his brushes hard with old paint and his palettes covered with dust; nor, indeed, could he progress at all had he to institute a long search for each fresh brush as he required it. Why should it be thought that things are different when a man's tools are of wood and steel instead of canvas, hair, and paint. There is no true difference, and if a carpenter, amateur or professional, wishes his glue to hold tight, he must not dry it to a cinder one day and deluge the chips on the next occasion. It makes all the difference in the world whether it is a compound of dust scrapings in the side of the pot, or whether bright and fresh, and of a consistent thickness. If our planes are full of gaps, and our saws blunt, no extra labour will make the result satisfactory. If the shop is dusty and dirty, everything will suffer, from the new paint on the wheelbarrow to the oak stain on a box or stool.

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RUST SPOTS ON LENSES may be readily removed by placing the spots in contact with chlorhydric acid diluted with a little water.—*La Nature*.

## HOW TO MAKE A VACUUM TUBE ROTATOR.

By *ELECTRON*.

HE tube rotator is used in connection with a Rhomkorf coil, for showing what is known as Gassiot's Star, by the rotation of a vacuum tube. These tubes were first constructed by M. Geissler, and are known in this country by the name of Gassiot tubes. When the tube is rapidly rotated, the impression is retained in the eye, and, instead of one, it appears as a number of tubes, forming the radii of a star. The tube is connected with the coil to be illuminated, and the rotator is worked by a separate battery.

Fig. 1 is a side view of the instrument, and Fig. 2 an end view, drawn three quarters full size. It consists of a bobbin or coil of silk-covered copper wire, in the lower portion of which is fixed a soft iron core; in the upper portion an iron core is arranged to work in and out of the coil; a connecting-rod is fitted to this core, which works the axle by means of a crank; a flywheel is fixed to the axle, the momentum of which carries it over the centres. The wires are arranged so that when the crank has passed the top centre, the coil, by its induced magnetism, attracts the core, which brings the crank to the low centre. The current is now stopped, and the momentum of the flywheel carries the crank round to the top centre again. At the outer end of the axle a pulley of boxwood is fixed, with two brass arms, to which the tubes are fixed by screw clamps. These arms are connected, so that a current of electricity from the induction coil passes along each arm, and from thence through the tubes, and illuminates them.

The bobbin for the coil is of boxwood, with flanges or ends  $1\frac{1}{8}$  inches diameter and  $\frac{1}{4}$  inch thick. The full length is 2 inches, and it is wound with five coils of No. 22 silk-covered copper wire, an end of the wire being brought through a small hole in each flange of the coil. The standard is of brass,  $5\frac{3}{4}$  inches high, and made as shown, with two feet for screwing it to

the baseboard, and three cross-pieces in it, to the two lower of which the ends of coil are screwed by small screws passing through the

end of the movable core. The movable core is of soft iron, 1 inch long and  $\frac{1}{4}$  inch diameter. To each end of the core is fixed a straight brass

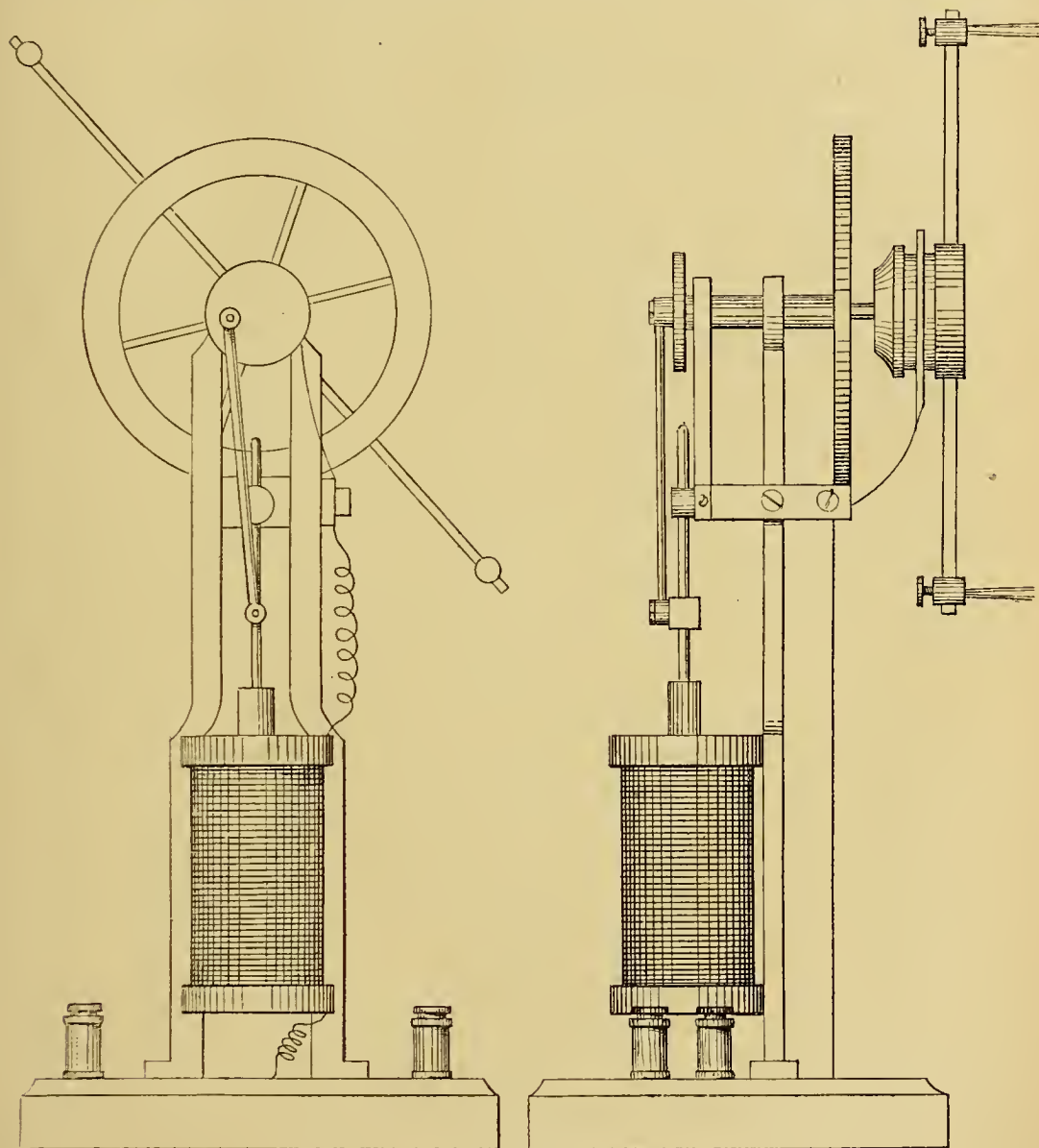


FIG. 1.—SIDE VIEW OF TUBE ROTATOR. THREE-QUARTERS FULL SIZE. FIG. 2.—END VIEW OF TUBE ROTATOR.

brass and into the flanges of coil. In the lower half of coil a soft iron core is fixed fast. This core has a hole  $\frac{1}{16}$  inch diameter drilled through its centre, which forms a guide for the lower

wire,  $\frac{1}{16}$  inch diameter. The lower wire works through the hole in fixed core, and the top wire through a brass guide, which is screwed to the top cross-piece of standard. The top of the

standard has two bosses formed on it  $\frac{3}{8}$  inch long, which are drilled for the axle to work in, and, from their length, form a good bearing for the axle. The axle is of brass,  $\frac{1}{8}$  inch diameter and  $2\frac{1}{8}$  inches long. To one end of the axle is fixed a crank disc, about  $\frac{3}{4}$  inch diameter and  $\frac{1}{8}$  inch thick, with a boss at the back; adjoining the crank is fixed a cam about  $\frac{3}{8}$  inch diameter and  $\frac{1}{16}$  inch thick. About two-thirds of the edge of the cam is lowered  $\frac{1}{16}$  inch, the remaining portion, by means of a brass spring which presses against it, sending the current round the coil as soon as the crank has passed the top centre. The axle may now be fixed in the bearing in standard, and the flywheel keyed on at the opposite side of standard. The flywheel is about  $2\frac{1}{2}$  inches diameter. A cross-head is fixed to the wire in the top side of movable core, and from this a connecting rod,  $2\frac{1}{4}$  inches long, is fixed, and connected to crank disc by small screws. The distance of crank pin from centre of crank is  $\frac{1}{4}$  inch, making the stroke  $\frac{1}{2}$  inch.

A baseboard of mahogany, polished or varnished, about  $8\frac{1}{2}$  inches square, and moulded on the upper edge, must be prepared; the underside must be cut out to clear the wires and connections.

The standard is screwed to baseboard by screws in each foot, which are put through from underneath, and which have brass washers under the heads, to which the wires are connected. The feet must be filed square, so that it stands square from baseboard when screwed up. A cross-piece of brass, about 1 inch long, must be screwed to one edge of standard, as shown in Fig. 2. To one end of this piece of brass a spring of brass is screwed, which presses against the raised part of cam, and which is arranged so that the cam comes in contact with it as soon as the crank has passed the top centre, moving from right to left, and loses contact as soon as the crank has reached its lowest position, the spring being clear of the cam during the remainder of the stroke.

The end of the wire from top end of coil must have the covering taken off, and the wire cleaned with emery cloth, the end turned into a small ring, and fixed by the same screw to the

top side of spring. Two binding screws must be fixed to one side of the baseboard, and two of a different pattern, or painted, to the other side of baseboard.

Clean the end of wire from lower end of coil, pass it through a hole in baseboard, and connect it to one of the binding screws at left-hand side of baseboard. The screw in the foot of the standard is connected to the other binding screw on the left-hand side of baseboard.

The axle, crank, and connecting rod must be made to work easily, and with as little shake as possible. The electric current acts on the instrument in the following manner: it passes from the binding screw round the coil, when the spring is in contact with the cam, and the crank being now just past the top centre, the soft iron core is drawn into the coil, carrying the crank down to the lowest centre, when the spring leaves the cam and contact is broken, but the momentum of the flywheel carries the crank back to its former position, when the spring being again in contact with the cam, the current again draws down the core, and so on alternately, the current passes from the spring through the cam, the axle, and down the standard to the other binding screw.

A separate battery, independent of the battery working the Rhomkorf coil, is used for working the rotator.

The apparatus for illuminating the tubes is connected to the outer end of the axle. A pulley of dry boxwood, about 1 inch diameter, and grooved, as shown in Fig. 2, is fixed on the axle. The hole in the centre is bushed with brass, so as to make better contact with the axle. Two arms of brass wire,  $\frac{1}{16}$  inch square, are screwed into opposite sides of the boxwood pulley. One of these pieces of wire must be in contact with the brass bush. To the other arm a piece of fine copper wire is fixed, which is wound round the groove in pulley. A piece of copper wire, about No. 18, is beat out flat at the end, and a ring is formed in the wire, about 2 inches from the end, by which it is screwed to the end of the cross-piece on standard, and the remainder of the wire carried down through baseboard and connected to one of the binding



screws at the right-hand side of baseboard. The wire, where flattened, is bent, so as to press on the copper wire wound round groove in pulley. The screw in foot of standard, at right-hand side of baseboard, is connected to the other binding screw at that side. On each arm, fixed in the boxwood pulley, a piece of brass about  $\frac{1}{4}$  inch diameter, with a square hole in it, is fitted to slide on the wire, and can be set at any part by a small screw at the back; at the other side, two pieces of brass spring, 1 inch long, are joined to each, the inner spring having a hole drilled in it, through which the wire in the end of the vacuum tubes passes and makes contact against each outer spring. These pieces are arranged to slide on the wire arms, so that tubes of various lengths may be fixed in them. When fixing the tubes, they should be made central with the axle.

The current from the coil passes through the tubes in the following manner: A wire from one of the binding screws of the secondary coil is connected to one of the binding screws at the right side of baseboard; the current from the coil passes along this wire to the binding screw, and from thence, by the wire, to the spring, and from the spring, through the wire along one arm, to the tube. After passing through the tube, it passes down the other arm to the axle, and down the side of standard to the other binding screw, and thence back to the coil.

It will thus be seen that, although the tube may be revolving, the current will still pass through it, from the spring pressing on the wire in the groove, which is in connection with one of the arms.

**A USEFUL CEMENT.**—For cementing iron railing tops, iron gratings to stoves, etc., the following mixture is recommended: Equal parts of sulphur and white-lead with about one-sixth proportion of borax are thoroughly mixed. When this mixture is to be applied it is wet with strong sulphuric acid and a thin layer of it placed between the two pieces of iron, these being at once pressed together. In five days it will be dry, the work having every appearance of welding.—*Scientific American*.

## A FANCY WALKING-STICK FOR AMATEURS.

By a LIGHTKEEPER.



SEVERAL articles on walking-sticks have appeared in *AMATEUR WORK*; but I have lately made three sticks of a fancy pattern, which I think might be interesting to amateurs. There is little difficulty in making this stick, only some care and patience being necessary. It can be made of any two kinds of wood that are light or white and dark. I have made one of walnut and planetree, one of mahogany and birdseye maple, and another one of walnut and common white birch. The lengths required for the stick (exclusive of the head or crook) are 2 feet 8 inches long,  $1\frac{1}{8}$  inches broad, by  $\frac{1}{2}$  inch thick; one each of this size of light and dark wood. But to those who, perhaps, may not have wood this length, four pieces half the length will do equally as well, as it has to be cut into short lengths, from  $\frac{1}{2}$  inch to  $\frac{3}{4}$  inch, as I shall show further on.

The first thing to do is to plane or dress these pieces of wood (two or four, as the case may be) straight and true, and square on the edges to the sizes which I have already mentioned. Then glue them together, as shown at Fig. 1, taking care that the edges of both pieces have the grain of the wood running the same way. In gluing together, those who have plenty of small hand-screws can readily screw the pieces together firmly till the glue gets dry; but not having hand-screws myself, I had to fall back upon a more primitive method, but, nevertheless, a very effectual one. After gluing and setting the pieces fair together, I took a grip of each end with a hand-vise, and then took a strong piece of soft packing cord, and seized them as hard as I could from end to end; when, after forty-eight hours' drying, they were as firm together as if one piece of wood.

The next performance is to run a groove down the middle of this piece of wood on both edges, so that the one half of the groove is on the dark wood and the other half on the light wood; it will then have the appearance of Fig. 2. The size of this groove depends entirely

upon what the centre or heart of the stick is to be made of, whether of wood or iron. The usual thing is wood, of  $\frac{1}{4}$  or  $\frac{5}{16}$  inch square; but I made mine of  $\frac{3}{16}$  square iron rod. But whatever the centre is made of, this groove must be run the exact width and exactly half the depth that it is wide. When this is done, then, with the gauge

of the stick. If of iron (which I strongly recommend, as the wood centre yields too much and breaks the glued joints) it will require a button at one end something like the head of a nail, and it must be left an inch longer than the wood that is to go on it. File this inch round and run a screw thread upon it, and also

FIG 1

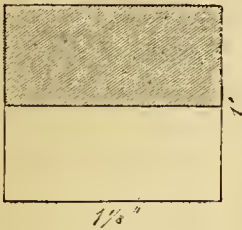


FIG. 2.

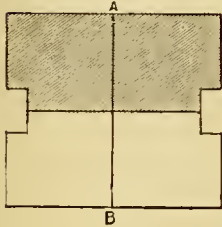
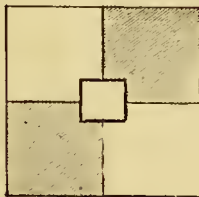


FIG 3



set at half an inch, mark from both edges on both sides. This will leave  $\frac{1}{8}$  inch in the centre between gauge marks. Now rip this down between gauge marks, through the centre line, A B, Fig. 2. Now dress down exactly to gauge mark; reverse and glue together again, as shown at Fig. 3. The stick will now be 1 inch square and parallel from end to end, the  $\frac{1}{8}$  inch having been allowed for saw cut.

The next thing to do is to prepare the heart

FIG 7.

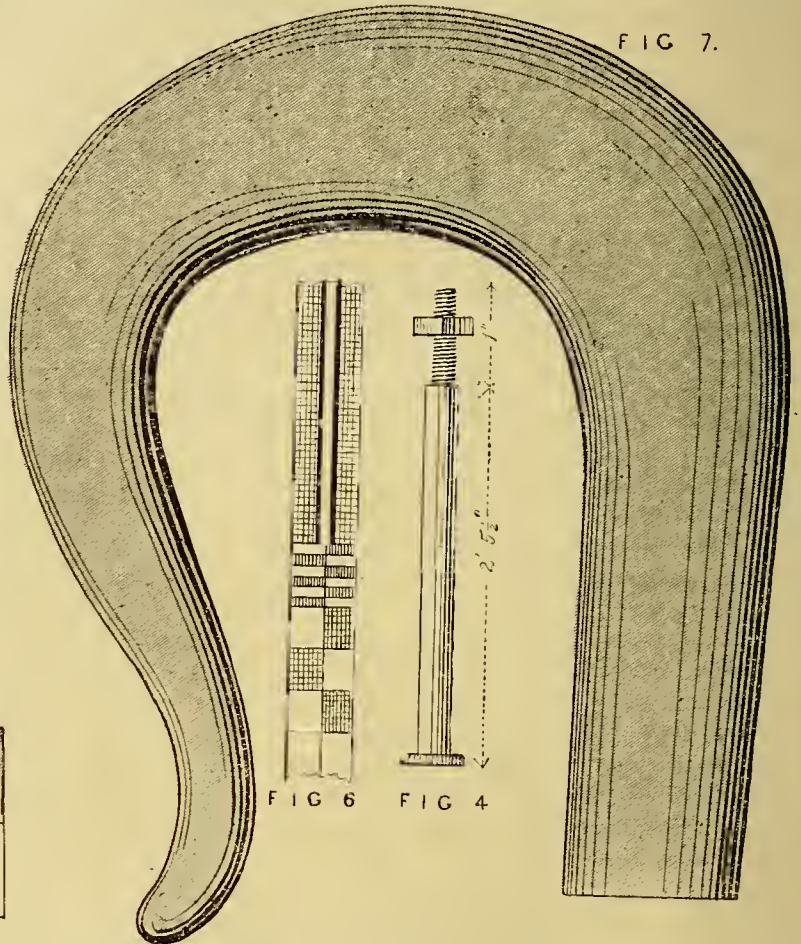


FIG 6

FIG 4

tap a small nut to run upon this screw thread, similar to Fig. 4. Now take your mitre box (which generally has a square cut at one end), lay the piece of wood in the box, and, with a fine tenon saw, cut off  $1\frac{1}{2}$  inches for lower point of stick, where a brass ferrule has to go on. Pare the cut ends of all rags from saw, and run this on to centre against the button. Now cut off six or eight pieces  $\frac{1}{2}$  inch long, and after trimming, run these on to centre, always reversing the



pattern, or, in other words, putting dark square against light, and *vice versa*. Then gradually increase the lengths of the cuts towards the top of the stick,  $\frac{3}{4}$  inch being the largest to be cut. These are all to be trimmed and run on to the centre. When  $\frac{3}{4}$  inch from top of square of centre, cut six cuts  $\frac{1}{8}$  inch thick, and put these six on the reverse way to the others. Now lift off these thin cuts, draw up the other cuts, and commence at the lowest joint; put in plenty of good glue, and set every cut fair with the one below, set them tight together as the glue is put between each joint. Put on the thin cuts the same way, and when all are on and glued, put on a  $\frac{5}{8}$  inch iron washer, run on the nut, and screw the whole firmly together.

Now, when this has dried for forty-eight hours, the stick is ready to be tapered and rounded. This is the most particular part of the work, as a good many of the cuts will be against the grain of the wood; this must be done with a very close-mouthed half-long, either of wood or iron, very carefully and keenly set. Before tapering the stick (which must be when finished slightly less than  $\frac{1}{2}$  inch at point and  $\frac{7}{8}$  inch at top), take off any surplus wood with a sharp chisel; then taper the stick equally down on the four sides, and take off the corners. Finish off with coarse and fine files, and coarse and fine sand-paper.

The stick is now ready for the head or crook, which can be made of one solid piece of wood or of several pieces, and any pattern the maker may fancy. But I shall describe how I made mine, and let others do as they please. I took a thin piece of planetree,  $5\frac{1}{2}$  inches long by  $4\frac{3}{8}$  inches broad, and planed it down equally to slightly less than  $\frac{1}{8}$  inch thick. Then I took a piece of mahogany of the same size,  $\frac{1}{4}$  inch thick, dressed

it on both sides; then, with a fine saw, ripped it through the middle; then glued one of these on each side of the thin piece of planetree, screwed it tight up in the bench-screw till the glue was dry; then dressed it on both sides till the mahogany was fully  $\frac{1}{16}$  inch thick; then traced

the pattern of crook on this with a black-lead pencil, and cut it out with fretsaw. Then I took two pieces of walnut of the same size, but  $\frac{3}{8}$  inch thick, traced this pattern on both of these, and cut them out with fretsaw; then glued one of these on each side

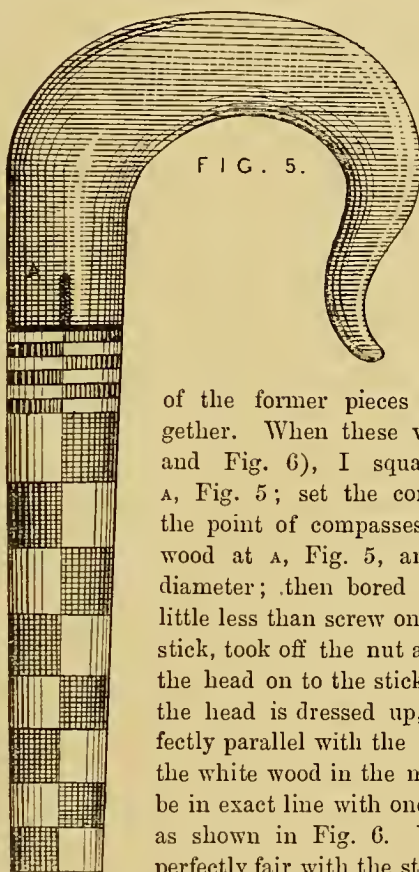


FIG. 5.

of the former pieces which were glued together. When these were all dry (see Fig. 5 and Fig. 6), I squared the end of head, A, Fig. 5; set the compasses at  $\frac{7}{16}$  inch; set the point of compasses in the centre of white wood at A, Fig. 5, and scribed circle  $\frac{7}{8}$  inch diameter; then bored a hole in this centre a little less than screw on end of rod for centre of stick, took off the nut and washer, and screwed the head on to the stick. By doing this before the head is dressed up, it can be adjusted perfectly parallel with the stick, and the centre of the white wood in the middle of the head must be in exact line with one of the joints of pattern, as shown in Fig. 6. When the head is fitted perfectly fair with the stick, then unscrew it, and dress it down nearly to its finished size with spokeshave, sharp pocketknife, etc.; then put glue between the faces and in the hole, and screw it hard up in its proper place, and give the finishing touches to the whole stick (when the glue is dry, of course), and finish off with Spencer's Instantaneous Polish.

I also give a full sized drawing of the crook (Fig. 7) I made for head of stick, and a sketch of stick when finished, as shown in Fig. 5. I hope I have made my meaning intelligible, but shall be happy to answer any inquiry through "Amateurs in Council." I may add, that in



screwing on the head to the stick, it is necessary to seize or wrap the end of the head round with a piece of soft wrapping twine to prevent the screw from bursting the glued joints. This happened to me with the first stick which I made.

## GALVANIC BATTERIES.

By ALLAN TRAYNOR.

### III. — CHLORIDE OF SILVER CELL — BICHROMATE OF POTASH CELL—HOW TO WORK THE BICHROMATE CELL—CHROMIC ACID—TROUVE'S SOLUTION.



#### CHLORIDE OF SILVER CELL.—In

this cell the positive element is zinc, and the negative chloride of silver, laid on a plate of silver-foil. The containing vessel may be a tube of vulcanite, indiarubber, or glass, 3 inches long, and about 1 inch diameter (Fig. 7). The zinc, which may be ordinary sheet, is in the form of a small cylinder well amalgamated. In cutting to shape, leave a lug, *L*, to which a short length of copper wire is to be soldered. The length of the cylinder may be about 1 inch, and its diameter such as will allow it to be passed into the tube and held there.

In arranging the elements, insert the zinc in the tube first, leaving it near the middle of the tube. A round plug of wood or cork is next inserted in the tube, its position being shown at *P*. The space between *P* and *B* is filled with pure melted sealing-wax, which is allowed to overlap the rim and set. A strip of very thin silver-foil is now rolled round a piece of hard wood, *K*, *K*,  $1\frac{1}{2}$  inches long, and about the diameter of an ordinary lead pencil. When the foil is rolled, a small hole is pierced in its edge, through which the end of a short piece of annealed silver wire is fastened.

In many descriptions of this cell, as given in the text-books and elsewhere, it is said that the chloride of silver is fused on to the silver-foil. The fusing process is apt to be carried too far, especially by amateurs. When silver chloride is fused too much, the chloride is brought back to the metallic state, a result which is not wanted. It is really not necessary to fuse the chloride of

silver. Take a small quantity and make it into a paste with water, and add a pinch of unslaked lime. A strip of stout blotting paper, of a size that can be rolled round *K*, *K*, is now covered with the chloride of silver paste, and rolled round *K*, *K*, with the chloride next the silver-foil. A piece of muslin should now be wrapped twice round the blotting-paper, and fastened with thread wound round several times. The blotting-paper, muslin, and thread, act as a porous partition. Another plug with a hole in its centre fits the tube at *M*. The diameter of the hole is to be such that *K*, *K*, can pass through it. Before inserting this plug, prepare a weak solution of sal-ammoniac, and pour sufficient into the tube to occupy the space between *C* and *P*, when the chloride of silver element is placed within the zinc cylinder already in its place. Now pass the plug with the central hole in it into the tube, so that the end of *K*, *K*, protrudes. The silver element is thus prevented from touching the zinc. Fill from *M* to *A* with melted sealing wax. The wires, *K*, *K'*, form the outer connections.

The cell stands high in E.M.F., being 1.19 volt. Its constancy depends entirely on the quantity of chloride of silver employed, as the action of the cell converts the chloride into metallic silver. From six months to one year is about its average life with intermittent work. It is admirably suited for ringing bells, working medical coils, or for testing purposes where portability is desired, with no chance of spilling.

A handy arrangement of the cell may be mentioned here. A tube of zinc may be employed to act not only as the positive element, but also as the containing vessel. The ends of the tube may be furnished inside with a thread and ebonite lids screwed into them. To one of the lids a small binding screw is attached, with which the silver element must make metallic contact, but care must be taken that the circuit is not completed *within* the cell by silver and zinc touching each other. A second binding screw may be soldered to any part of the zinc.

With regard to the chloride of silver itself, it may be either purchased or prepared by the amateur. The writer has found that the cheapest

shop at which to purchase is the photographer's, as it is one of the main residues in photography. Its appearance closely resembles chalk, both in formation and colour; or it may have a slightly greyish tinge and be in the form of flakes.

In the making of chloride of silver there is no great difficulty. All that is required is a threepenny-piece, a test tube, a small quantity of nitric acid, and a spirit lamp. Cut the threepenny-piece into two halves, and having cut one half into small pieces, place them in the test tube. The next part of the operation should be performed in the open air. Pour a little nitric acid into the tube, and set it over the flame of a spirit lamp. The liquid will be seen to undergo a change. First, it turns yellow, then a light brown, and, lastly, red, with dense red fumes. It is better to stand back from the operation to avoid breathing the fumes. When the red fumes cease the silver should be all dissolved; but, if on examination, it is found that this is not so, a little more acid may be added. When it is seen that the silver is dissolved, remove the tube from the spirit lamp, and having prepared a solution of common salt and water in a glass dish of any kind, pour a little among the liquid in the tube. A white precipitate is at once formed. Salt solution should be added till the precipitate ceases, or the entire contents of the test tube may be poured into the dish containing the salt solution. This white precipitate is chloride of silver. Allow the dish to remain at rest till all the chloride has fallen to the bottom. The liquid should then be carefully poured off, and the chloride washed by pouring water upon it, allowing the chloride to settle, and then pouring the water off. This should be done several times. The chloride is insoluble in water, so that there is little fear of losing any, unless it be carelessly poured off.

*Bichromate of Potash Cell.*—When a powerful current is frequently wanted for short periods, the bichromate of potash cell is the most convenient. For experimental purposes it is, perhaps, the most useful cell available. It is absolutely free from fumes, and when it is allowed a rest after work, it rapidly recovers.

The most common form is shown at Fig. 8. The containing vessel, *a*, is a glass bottle, shaped

like a globe. The glass is blown out to this shape in order to have plenty of liquid about the elements, as the greater the quantity of liquid in the cell the longer will the current last. The ebonite cover, *k*, which closes the bottle, carries two plates of carbon, *c, c*, parallel to each other, the one in metallic connection with its neighbour. A zinc plate, *z*, is screwed to a brass rod, *b*, which slides in a socket fitted to the cover. The carbons are in connection with the binding screw, *s*, and the zinc with the binding screw, *s'*. The carbons are always in the liquid, but, by means of the sliding rod, the zinc can be lifted clean out of the liquid when it is desired to put the cell out of action. A set-screw, *x*, in the socket, prevents it from sliding back, and by this means the strength of the current may also be regulated by immersing the whole or only a part of the zinc.

The zinc plate should always be the same width as the carbons, but half their length, and its top furnished with a piece of ebonite, made to fit between the carbon plates, to prevent carbon and zinc from touching within the cell.

The exciting liquid is made by dissolving 3 ounces of crystals of bichromate of potash in 1 pint of warm water. It will hasten their solution if the crystals are crushed small before being put in the water. Stir the water with a glass rod after the crystals are added. When the water becomes cool, 2 ounces of sulphuric acid are poured into it in a thin stream, stirring the while. The addition of the acid generates heat, but when cool again, the solution is ready for use. Only the globe of the containing vessel is to be filled with the solution.

Fig. 8 is the usual form of bichromate cell. It is a form seldom constructed by amateurs, as the glass bottle makes it expensive. Any form of containing vessel will be suitable, provided it is not too small. Cells may be constructed with ordinary jelly jars, having all the advantages of the form described. These jars (Fig. 9), should not be less than about 5 inches deep, by  $2\frac{1}{2}$  inches in diameter at the rim. The arrangement of carbons and zinc is shown at *c, z, c*. Two pieces of thin hard wood, 3 inches long,  $\frac{1}{2}$  inch broad, and  $\frac{1}{8}$  inch thick, are employed to prevent the

zinc and carbon from touching. The lid of an empty cigar-box is admirably suited for breaking up into the pieces of wood required. Before fitting the elements together, solder a binding screw to the top edge of the zinc, placing it near one corner, as shown at B. A piece of the wood is now placed at each side of the zinc, at the end

shown at G. A length of stout brass wire is tightly bound round the neck of the jar and made to terminate in a hook, as shown at H. The jar is three-quarters filled with the bichromate solution. When in action the plates are inside the jar; when out of action the plates are lifted and suspended by the hooks G and H.

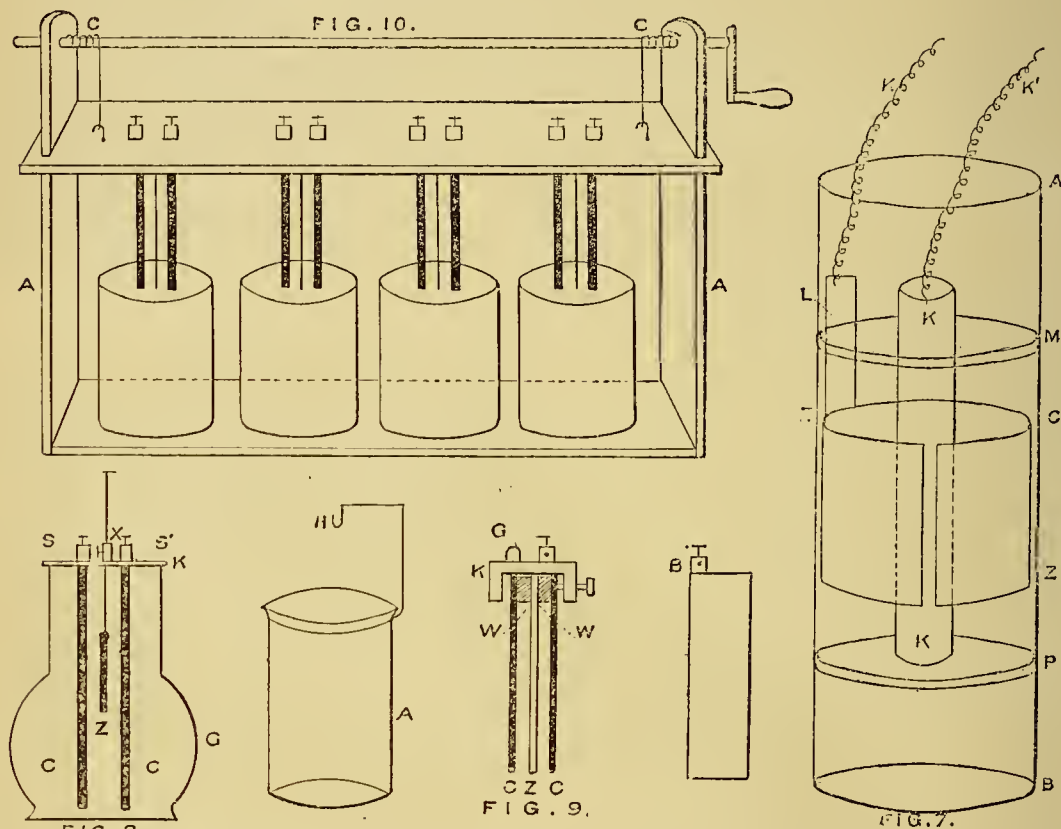


FIG. 7.—CHLORIDE OF SILVER CELL.—C, Z, Zinc Cylinder with Lug, L; K, K', Piece of Wood on which Silver Foil and Silver Chloride are rolled; P, M, Cork or Wooden Plugs; A, B, Tube of Glass, Vulcanite, or Rubber; K, K', Connecting Wires. FIG. 8.—BICHROMATE OF POTASH CELL.—C, C, Plates of Carbon; Z, Zinc Plate. FIG. 9.—CHEAP BICHROMATE CELL.—A, Jar, with stout brass wire fitted round its neck and terminating in hook, H; Z, Zinc Plate between Two Plates of Carbon, C, C; W, W, Pieces of Wood between Zinc and Carbons; K, Clamp, binding parts together, having small hook, G, of brass wire soldered to it; B, Position of Binding Screw on Zinc Plate. FIG. 10.—LARGE BICHROMATE BATTERY.

to which the binding screw is attached, and the two carbons are then placed one against each piece of wood, and parallel with the zinc. A brass clamp, the same as was described for the Smee cell, keeps the parts together. A small hook of brass wire is soldered to the clamp, as

When a large battery is required, it is most convenient to arrange the cells in a box, as in Fig. 10, which may be made to hold as many cells as are necessary. The plates are all attached to a wooden top, as shown, through which the binding screws pass. The elements



are lowered or raised by means of the handle and shaft moving the top upon the sides, A, A, with cords, c, c.

*How to Work the Bichromate Cell.*—The bichromate is, perhaps, the best cell we have for yielding a powerful current for a short time. Where a continuous and long-sustained current is required, it is useless, as its force falls very fast; but when employed at its proper work—generating a powerful current of small duration—no better cell can be had. The liquid will keep any length of time; but should its bulk be small, it will not work for more than fifteen minutes at a time. Containing vessels should not, therefore, be too small. The most suitable are those which hold one pint and upwards. If the liquid could be got to circulate, the great defect of the cell would be overcome, as it is the want of circulation that weakens the current so soon. Various methods have been tried to overcome the defect. For example, the flame from a gas-burner or a lamp, applied to the bottom of the cell, has been said to have caused a continuous current till the solution was exhausted. In Byrne's battery air is pumped into the liquid, causing circulation, and always bringing a fresh supply of oxygen, by which the life of the battery is prolonged.

In working bichromate batteries, the zinc should never be lowered into the liquid until the current is actually required, and it should always be raised whenever the operation has ceased. When the battery is in action, the fluid should be disturbed every few minutes. This may be simply done, either by raising and lowering the zinc, or stirring the liquid with a piece of wood or glass. Never leave the zinc in the solution. The battery may be set aside for weeks, and is ready for work at any moment, as the liquid keeps good for an indefinite time.

For all experiments where a strong current of short duration is required, no better cell could be had. Hence, it is admirably suited for working induction and medical coils, exploding fuses, and for short installations of the electric light. A small arc light can be produced from six cells of quart size. Twenty-four cells will produce

the true voltaic arc, allowing the carbon points to be separated visibly. It should be mentioned, however, that no more than half an hour's light can be got from any bichromate battery under ordinary conditions.

*Chromic Acid.*—When sustained action is wanted from the elements of a bichromate cell, the charge should be a solution of chromic acid instead of bichromate of potash. The charge of chromic acid yields a powerful current for about three hours. The current is slightly stronger than that generated by the bichromate solution, four cells being able to feed a five candle-power incandescent lamp. To make this solution, dissolve 3 oz. chromic acid in 16 oz. water, then add, slowly, 4 oz. sulphuric acid, stirring the while. Allow the solution to cool before being used.

One word about chromic acid is necessary, and this refers not to the solution, but to the acid, as it comes from the dealers. Whatever it may be contained in must be kept air-tight, or it will quickly melt.

*Trouvé's Solution.*—There is yet another solution for sustained action in the bichromate cell—that known as Trouvé's Solution, which gives a higher E.M.F., while the current is more constant than with the usual bichromate solution. The method of preparing it, and the proportion of materials are as follows: Put  $1\frac{3}{4}$  pints of cold water in a vessel which will hold a larger quantity. To this add 8 oz. of well-powdered bichromate crystals, and stir well to assist its dissolving. Add to this 15 oz. of sulphuric acid, drop by drop, slowly, and with constant stirring. The addition of the acid causes the solution to heat gradually, and the whole of the bichromate becomes dissolved. A perfect solution, which has no tendency to form crystals on cooling, is the result. In using Trouvé's Solution, the zinc must be carefully attended to for amalgamation. Repeated applications of mercury are necessary till a thick coating has been formed. The solution may be used in the ordinary globe-shaped bichromate cells, or in the more homely jelly jars, and one charge will yield a powerful current for three hours.

(To be continued.)

## ADJUSTABLE BAROMETERS: HOW TO MAKE THEM.

By JNO. H. MILNE.

### III.—METHOD OF RAISING OR LOWERING CISTERN—THE WHEEL BAROMETER—THE ANEROID BAROMETER.



SCREW should now be made out of a piece of brass, say,  $\frac{1}{8}$  or  $\frac{1}{4}$  inch thick, with a projection at the top, Fig. 10,

A. A piece of oak, B, the size of the bottom of the bottle, should have a hole made in it, just enough to allow the projecting piece or head of the screw to lie neatly in it. This is for the top of the screw for raising the cistern to work in. The bottom of the bottle, C, can have a piece of chamois leather or cardboard glued to it, so that the contact may be softer and closer; or the piece can be fixed to the top of the screw. Another clamp, D, say,  $\frac{1}{8}$  inch thickness, of brass, can be made and tapped for the thread of the screw to work in and be supported by.

Glue the piece of wood to the bottom of the bottle, or fasten it by one of the various cements now so common. Now the remaining parts can be fixed in their places on the baseboard, the clamps on the side of the bottle screwed down and nicely adjusted, as also the supporting clamp at the bottom. It will be found that the bottle can be regulated smoothly and nicely by means of the screw.

A piece of brass, about  $\frac{1}{4}$  or  $\frac{3}{8}$  inch broad, can be bent, as in Fig. 8, then a small square piece, with hole bored through, soldered on to it. A piece of ivory rod, or bone knitting-needle, can be fixed in the hole; then the angle screwed on to the baseboard, when the mercury would stand at, say, 29 inches, being the centre of the scale. The point can be set to just touch the mercury.

If it is intended to have a wooden cap to cover the cistern, as in Fig. 11, it should be so turned as to leave a hole in the centre large enough to expose the surface of the glass cistern, and sufficient to show the zero point and part of the surface of the mercury, in order to be able to set the instrument.

A hole will have to be made through the upper part of the cap, for the tube; beside it,

another, for the pointer; and a third at the bottom, for the regulating screw, which can project, say,  $\frac{1}{2}$  inch. Fig. 8, dotted circles show cap. If the cap is made, as in Fig. 11, with a glass face, especially if the glass is thick and bevelled, the effect will be improved.

If it is preferred, the cistern can be fixed, and the tube scale and pointer made movable by means of a screw from the top, the tube sliding between the fastenings.

The cistern instrument will also be found to register precisely.

It will now be well to give the reader a description of two well-known forms of barometer—the Wheel Barometer and the Aneroid.

The construction of the wheel barometer is given in Fig. 12. The tube is the ordinary siphon tube, but a weight of glass rests on the mercury, upon which it will float, as it is lighter than the metal. A silk thread is attached to it, which passes over a wheel and ends in another weight, which balances the first. When the mercury sinks in the short tube, which represents rising in the long tube, the weight in the short tube sinks, moving the wheel to the right, while the rise in the short tube, representing a fall in the long tube, moves the wheel to the left.

On the spindle of the wheel, outside, a finger or indicator is fixed, which moves over a graduated dial.

The outward appearance of the instrument is so well known, that a description is unnecessary. The dial over which the finger moves is divided to represent the four inches. The figures and words signifying the fall of rain being on the left of the circle, change usually at the top, and indications for fine weather on the right.

Although a household article, and oftener seen in houses than the column, it is unsuited for accurate observation, and the mechanical arrangements, among other reasons, rendering it less reliable than the column. It is never used for scientific purposes.

The aneroid (without air) is also well known. It is a small box almost devoid of air, and securely sealed to prevent the entrance of any. The weight of the air presses on the sides, top,

and bottom, which gives in proportion to the pressure. This movement is communicated to a lever arrangement, which moves an index finger on a scale.

The advantages of the aneroid is, that it will work in any position, and not being affected by movement, is well suited for the sea.

The mercury column was also used by mariners before the aneroid was invented, and still is in demand.

For marine purposes it is mounted in a round wooden frame, set in gimbals, *i.e.*, concentric rings with axes at right angles to each other, similar to the mounting of a compass. Thus whatever way the ship rolls, the barometer keeps the vertical line.

However carefully a mercury barometer be carried it will be noticed how easily and quickly the column is disturbed, rapidly rising and falling. This is so

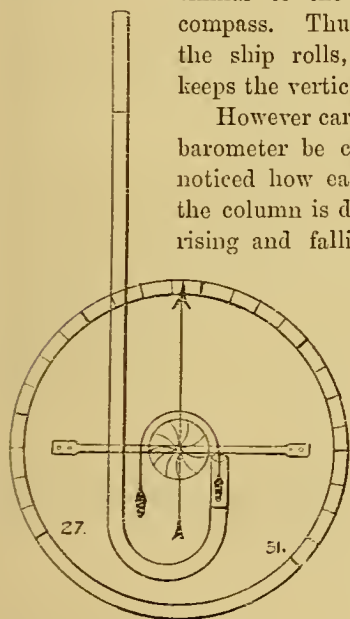


FIG. 12.

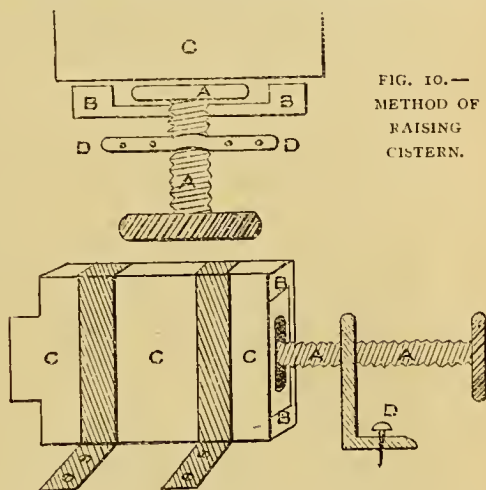
THE  
WHEEL  
BAROMETER.

on shipboard. Now, in order to prevent the jumping up and down of the mercury, caused by the motion of the vessel, the part of the tube parallel with the scale is made of much greater diameter than a certain portion of the remainder of the tube. This has the effect of preventing the undesirable movement of the mercury due to motion.

It would be well before closing this article to give the reader a hint as to lacquering and French polishing, for if he intends to make a barometer both of these arts will greatly contribute to the finished appearance of his work.

There is an idea among amateurs that these luxuries are only to be had at the hands of the professional workman. This, however, is not so.

First, as to lacquering. No doubt the skilled artisan produces beautiful work, without

FIG. 10.—  
METHOD OF  
RAISING  
CISTERN.

scratches, and of a brilliant lustre, but he has not only various appliances, but his work goes through various processes, before it arrives at such perfection.

The amateur can, however, after a little practice, without much trouble, produce very presentable work. Suppose he has a small piece of sheet brass he wishes to lacquer. He should buy a pennyworth of gold lacquer, and a soft camel-hair brush. The brass should be polished

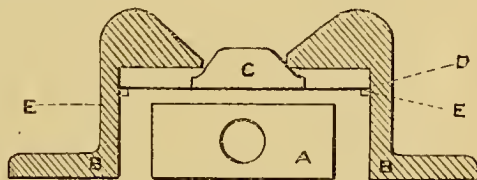


FIG. 11

WOODEN CAP TO COVER CISTERN.

A, Bottle; B, B, Cap; C, Bevelled Glass Face; D, Glass Plate upon which Bevelled Glass rests; E, Pins to support glass.

to as great a lustre as can be obtained, without scratches. He may take off all the roughness with a file, then use a very fine file, then sand-paper, followed by emery cloth and oil, and, as a final application, plate powder, or rouge with chamois leather, or he can use a "buff," which is a piece of wood covered with leather intended



for polishing metal, after having washed off the oil and emery.

A burnisher can be applied, if desired, for obtaining brilliancy of polish. In using this instrument a little weak beer is advantageous. Brass can also be finished by "dipping," *i.e.*, placing it clean and warm into nitric acid, and afterwards washing with cold water. This gives good results.

A good polish having been procured, as free as possible from scratches, the lacquering process begins.

Two difficulties are often experienced by amateurs: first, as to the heat requisite for lacquering, at the same time avoiding burning; second, to prevent the work chilling while lacquering. A word on each of these subjects will, no doubt, be serviceable to many.

The writer's experience is, that for small articles, such as the example given, the following rule works well: Hold the work by the end, with the pincers, over the gas flame. A dull whitish cloud will appear on the bright brass surface, which will pass off to one side. When the cloud passes off, the metal is about the suitable temperature. Now let the brush with the lacquer be quickly, evenly, and lightly drawn across the metal, then hold the metal over the gas again. Possibly a whitish cloud may come over the face of the work, which brings us to the second question, that of chilling. Many amateurs suppose when this occurs, which is due to draughts of cold air, causing the metal to cool too quickly, the work is spoiled, and proceed to scrape the lacquer off, which is an unpleasant and disappointing task. If, however, when they had observed the cloud forming, they had increased the heat by holding the work nearer to the flame, they would have found that it would have passed off like the former white cloud, leaving the surface bright and properly lacquered.

The proper heat, after a little practice, can be ascertained by holding the work, after warming, to the face, or a stroke of the brush on the back of the work, will be a guide. If the work is too hot the lacquer will be burnt and turn red. The gas can be used, or a bright warm fire. The lacquer brush should not be very wet, or the

work will be streaky, and the lacquer should not be painted on, but each part should be done with one quick, even stroke.

Amateurs are very fond of finishing their woodwork with spirit varnish, which dries very quickly, and gives very little trouble. However, if copal varnish is used, in the manner suggested in a former paper, by smoothing down each coat before applying the next, three or four coats being given, a vast improvement in the appearance of the work will be the result, but, best of all, the amateur, however inexperienced, should seek the acquaintance of the king of all polishes, French polish. No varnishing has the fine finish and lustre it has.

The reader has, no doubt, met with instructions for this kind of polishing. If he has not they will be readily supplied in "Amateurs in Council."

The cost of the construction of the adjustable instrument is only a trifle—hardly a shilling—more than the cost of the instrument described in the last volume, while, on the other hand, the reader will find that his instrument will give him considerably greater exactitude, and will fill the double capacity of being an efficient and reliable barometer, at the same time a pretty household ornament.

## A DRAINING RACK FOR PHOTOGRAPHIC NEGATIVES.

By ED. C. ROE, Junr.

**A**FTER we, who have the honour to be termed amateur photographers, return from an outing, during which we have succeeded in securing what we hope will prove to be good negatives, we find ourselves requiring a place wherein to deposit our negatives after development and fixing, prior to washing, while we develop others; or after washing them, to find a place to drain and dry them, previous to varnishing. In fact, at all stages of development and future treatment, the piece of apparatus, as described by the above heading, is simply invaluable. This must be my excuse for placing before you the following description, which, I trust will be found sufficiently clear, work from

easily and correctly. The details are to half and full size.

It being necessary for our purpose to decide upon a definite size to work to, I have ventured to take  $\frac{1}{2}$ -plate size ( $6\frac{1}{2}$  by  $4\frac{3}{4}$ ) as being a size very much in favour at the present time, but the rack is so constructed that it will also take  $\frac{1}{4}$  and lantern-size plates in safety.

We shall require for the construction some  $\frac{3}{8}$  inch stuff, which will finish but little more

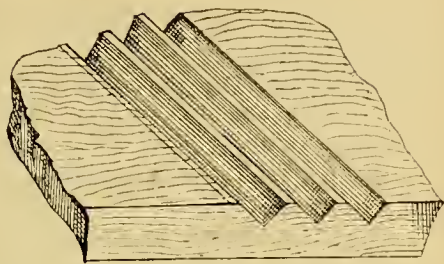


FIG. 1.—SECTION OF GROOVING.—FULL SIZE.

FIG. 3.—END VIEW OF  
DRAINING RACK.  
HALF FULL SIZE.

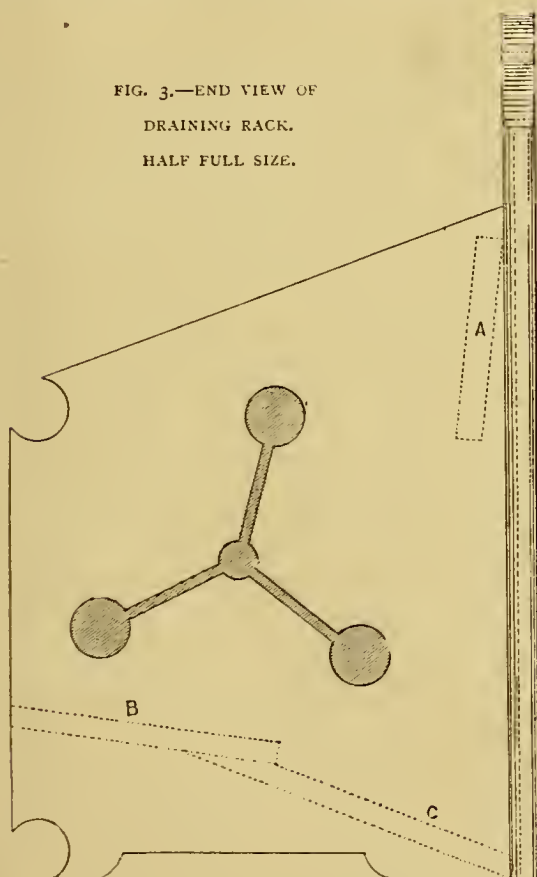
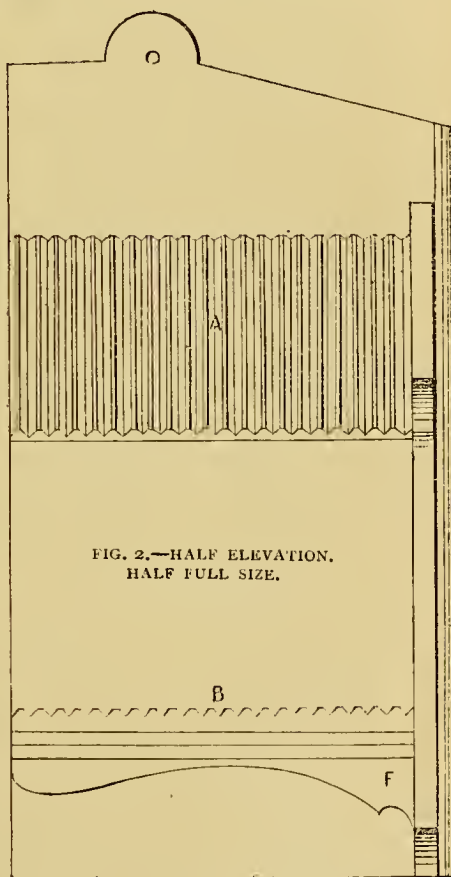


FIG. 2.—HALF ELEVATION,  
HALF FULL SIZE.



than  $\frac{1}{4}$  inch; pine, mahogany, or other material, whichever is most favoured by the worker; personally, mahogany is preferred, as being better able to withstand the dampness, which of necessity will be the constant companion of our rack.

The first thing it is advisable to do is to prepare the grooving, of which only a small

quantity is required; a piece of stuff, 6 inches wide and 9 or 10 inches long, will be sufficiently large for our purpose. This must be set out by means of a setting-out knife, or in default thereof, a penknife, in the manner shown, full size, at Fig. 1; the grooves may be cut out with a rebate plane, after making a saw kerf in the centre of each groove. The setting out of the

grooves should be across the grain. After the grooves are completed, cut down so as to make one piece 3 inches wide, and one piece 2 inches wide, being the pieces lettered A and B (Figs. 2 and 3) respectively.

We will now proceed with the back, cutting out for this a piece of stuff 9 inches wide and  $10\frac{1}{2}$  inches long, or longer at pleasure, and after planing it up, set out the housings for the side pieces, which housings are in width the thickness of sides, and in depth about  $\frac{3}{16}$  of inch. The cut top may be marked and cut with a fret-saw, or in default of this, a padsaw may be used; clean up with glass-paper, and bore a couple of holes for convenience in hanging up. After finishing this, round the ends carefully. The two sides must now be attended to, the ornamental part being done with centre-bit and brace, and a pad or fretsaw. The housing shown by the dotted lines must be cut about  $\frac{1}{8}$  of an inch deep, to take the grooved pieces, etc., as shown. The grooved pieces are cut to the length between the sides plus the depth of two housings. The under piece is cut out same length as grooved pieces, and fitted into each end, taking care to make the bevels fit accurately. The work is now ready to be knocked together; if we have worked truly, no difficulty should be experienced, if not, we must ease according to requirements. It is advisable to screw the whole together with  $\frac{3}{4}$  inch brass screws, No. 5 will be sufficiently thick, the heads must be sunk in level with face of work carefully. The ornamental piece of filling in F, may be cut out with fretsaw and fixed with a brad or two.

The rack being together, we may proceed to beautify it by means of paint, varnish or polish, as taste or inclination shall dictate, but whatever the means adopted are, the trough formed by C, Fig. 3, and the back, should have a couple of coats of paint inside to make it water-tight. It would be a good thing to paint the joint that C makes with the back, before putting together.

The rack should be hung up, if possible, over the dark room sink, on a couple of screws, so that it can be lifted on and taken off at pleasure. A hole must be bored in a suitable position to let off the drainings from the negatives.

It may appear to some that there is a lot of work for such an apparently minor piece of apparatus, but I feel sure that experienced photographers will agree with me, when I say that it is one of the most convenient and useful pieces of apparatus in my possession.

## EASILY ARRANGED SHOWER-BATHS.

By A. SINUS.

 IN a recent article on a Turkish bath, allusion was made to a shower-bath which could easily be arranged for use with it by those who are unable to avail themselves of the ordinary form. As the request has been made that a description of some appliance for use when the usual shower bath is not convenient, should be given, I have much pleasure in complying, and, I trust, the following suggestions may be of service to those who do not consider a Turkish bath complete without a subsequent shower. There are, at least, two classes to whom this improvised shower-bath arrangement will have special reference—viz., one with a constant supply of water from the main, and the other, who must depend on water from a jug or tank. In the former case, there will naturally be some pressure to carry the water above the bather's head; in the other, he must lift water, or store it in a tank overhead, from which to get the necessary fall.

As the first method affords the simplest means, and will, perhaps, convey a few ideas to those who have unfortunately not got water laid on, let us begin with it. In writing, I have in my mind certain arrangements of bath and water based on my own experience. Details will, of course, have to be determined according to circumstances, as I cannot possibly know what these are in each individual instance in which it may be desired to arrange a shower. A little ingenuity will, however, enable anyone to overcome apparent difficulties. In fact, some of my own improvised shower-baths are so ridiculously simple, that I am almost ashamed to occupy space by mentioning them. As they have not occurred to some of my friends



till I have spoken of them, probably the same will apply equally to my friendly readers.

The first and simplest arrangement in connection with water laid on is merely a piece of indiarubber tubing or garden hose-pipe with the ordinary rose nozzle. Very simple, but very convenient. Merely fasten one end of the tube to the tap, hold the rose to allow the water to shower over you, turn the tap, and there you are with a perfect douche. Now for a modification of this.

A tank or box with a perforated bottom, is fastened above the bath into which the water will fall, and in which, of course, the bather stands. This tank is, of course, the cistern to hold the water previous to the shower, and need only be a rough affair. The perforated bottom can easily be made by punching holes in a piece of sheet tin or zinc with a wire nail. It should be well fastened on, to prevent water pouring out at the joint with the wood, but if the nails used are sufficiently close together, there will be no difficulty in this respect. Well, having got this tank made and fixed, our second shower-bath is ready. But how is it to be filled? Well, just by means of the aforesaid garden hose, or other convenient tubing, which, in this case, need not have any rose at the end, as the perforated bottom serves the same purpose. It will be seen that any piece of piping which is long enough to lead from the top to the tank is sufficient, and that when a shower is wanted, it is only necessary to turn the tap on. Where there are hot and cold water taps, the luxury of a warm shower may be indulged in, or the shower be graduated from hot to cold, by merely manipulating the taps.

The foregoing arrangements are all very well when the water is laid on, as it generally is in towns, but in country districts, or even in rooms where there is no constant supply to be drawn from the mains, a water cistern of some kind—it may be only a wooden box, well covered inside with pitch, especially at the joints—must be placed at a convenient height, to allow of sufficient fall through a siphon, one end of which terminates in a rose. The necessity of having a tank may, however, in many cases, be an in-

superable difficulty, so here is a way by which it can be dispensed with. It is, in fact, a portable shower-bath, which may be used anywhere, and be moved from one room to another, as occasion requires. Of course, I do not mean to say that it is equal in all respects to a well-appointed shower-bath, for this would be claiming too much for it. It is, however, an excellent makeshift, and costs a mere trifle, even if it is made to order. As will be seen, however, there is no reason why anyone who can solder should not make his own. To give directions of a detailed kind for making is not, however, so much the object of the present hints, as to offer suggestions which any handy man can apply to himself.

All that is needed is a box of tin, or something equally convenient, with perforations at the bottom, but with the exception of a hole which can be covered with a finger or thumb near, or on the top, otherwise airtight. The lid, therefore, must be carefully soldered down. Now, to use this appliance, which depends on a well-known natural law, it is only necessary to fill it by sinking it in water, which will rise through the bottom to the same level inside the box as it is outside. The air escapes through the hole at the top, being forced out by the rising water inside. If the box be lifted, the water will, of course, rapidly pour out from the same sources by which it entered—provided the upper hole be not covered. Close it tightly with a finger, and the full box may be raised without much escape of water. Raise the box, therefore, when taking a bath, over the head, with the hole covered. Remove the finger, and the water falls in a shower. If the box or tank does not hold enough water to satisfy you with one shower, repeat the operation, of course, filling the tank from the bath, which it may fairly be assumed the bather is standing in. I believe that, in an improved form, this pneumatic portable shower-bath has been made the subject of a patent. In it the air-hole is in a hollow handle, which may be a convenience when lifting the water. I have not tried it, and, had I done so, a description could hardly have been given without the risk of, by implication, in-

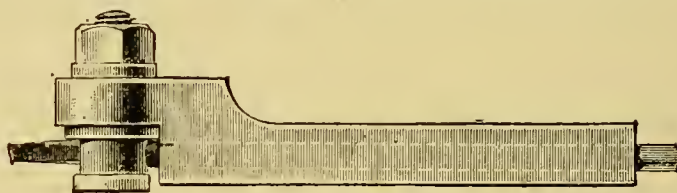
ducing readers to infringe a patent, or advertising the makers. Neither of these is the desired object of the writer so much as to show how, by the very simplest arrangements, anyone almost may enjoy the luxury of a shower-bath. He trusts he has succeeded, so that the Turkish bather at home may no longer be in doubt how to refresh himself with the shower before "cooling down."

## NOTES ON NOVELTIES.

By THE EDITOR.

9. REPOUSSE WORK. 10. MECHANICS' ALMANACK. 11. SKINNER AND CO.'S CATALOGUE. 12. NATURALISTIC PHOTOGRAPHY. 13. A PATENT TOOL-HOLDER. 14. DONEGAL INDUSTRIAL FUND. 15. MODEL LOCOMOTIVE CASTINGS.

9. **R**EPOUSSE WORK.—Mr. R. Stebbings, 38, Brewer Street, London, W., sends me a leaflet containing his price list of tools and materials used in the art of metal embossing or repoussé work. In addition to this, it also embraces a page of useful hints on the operations involved in the work. Any reader can have a copy of this list by enclosing a



PATENT TOOL-HOLDER.

stamped addressed envelope to the address given above. As Mr. Stebbings has taken the Bronze Medal of the Society of Arts, in addition to other prizes, etc., for Chasing and Repoussé work, he may be fairly considered an authority on the matter.

10. *Calvert's Mechanics' Almanack*.—This calendar, which I suppose finds its way into nearly every workshop in the United Kingdom, has now reached its seventeenth year of publication; and the present issue, which is full of useful information of all kinds, quite sustains the reputation gained in previous years. This almanack is published at 4d.

11. *Skinner and Co.'s Fretwork Catalogue*.—Messrs. Skinner and Co., East Dereham, send me their new catalogue of Fretwork materials. It is excellently got up and contains a large amount of information useful to amateur woodworkers in general. I am especially pleased with their Eclipse Series of Fretwork Designs (copyright), most of which have the merit of forming large and useful articles of furniture. All of these designs are drawn in sections and can be conveniently cut by the ordinary fretsaw. The following are particularly good:—No. 177. Japanese Cabinet with shelves. No. 178. Ornament for library, with receptacles for papers, etc. No. 179. Conical standing Cabinet. No. 210 is a very elegant design for a Corner Bracket, well

worth cutting, and No. 211 is a handsome design for a Table Whatnot, 25 inches high, and 16 inches square at base. Messrs. Skinner and Co. are also makers of photographic materials, of which I may have something to say in a future Part.

12. *Naturalistic Photography* (Published at 5s. by Sampson, Low, Marston, and Co.).—Dr. Emerson's splendid work on photography which was eagerly looked forward to by the photographic world, amateur and professional alike, has rapidly and deservedly reached a second edition, and must already have done much to assist the art of photography. It is, without doubt, the most complete work on the subject yet produced; and is written in so fascinating a style, that once having taken it in hand, it is only laid aside with reluctance. It is not merely a compilation of hackneyed formulæ, but has a bold and vigorous treatment that enlists the interest of the reader even though he may not agree with the author's views of art. The book is full of suggestions that will prove invaluable to all who aim at turning out first-class work, such as Dr. Emerson himself well knows how to produce.

13. *A Patent Tool-Holder*, invented by B. H. Bent, B.A., Demonstrator of Applied Mechanics, University of Cambridge, and supplied by the Britannia Co., Colchester, is one of the best tool holders for boring and cutting internal threads. The cutters or tools can be made of round rod which is easy to obtain. They are held firmly, and in boring it is so easy to adjust depth of cut. Various sizes of steel can be used in the same holder. It is an economical tool, no

skilled smith being required to forge them. It can be used for ordinary turning, sliding and surfacing.

Prices {  $\frac{3}{4}$  10/-  $\frac{1}{2}$  10/-  $\frac{3}{4}$  12/6  $\frac{7}{8}$  15/- 1-inch. 17/6 Post Free.

14. *Donegal Industrial Fund*, 43, Wigmore Street, London.—I have been favoured with a memorandum on the work and technical teaching of this Fund, the object of which is to provide sound technical teaching and industrial work in the large field of untrained labour existing in Ireland. A very gratifying success has already attended the efforts of the Fund, which are based upon sound commercial principles. A letter to the above address will procure a list of things useful and beautiful, of honest workmanship, sold at ordinary market rates of prices, and anyone purchasing through this Fund will benefit himself and his fellow-men at the same time.

15. *Model Locomotive Castings*.—"J. H.," who is the author of "Fitting and Erecting," sends me his price list of castings of a model locomotive having driving wheels 8 inches diameter, and cylinders, 1½ inch bore by 2½ inch stroke. It is unnecessary to say that these castings are of the very highest quality, and anyone interested in model making will do well to enclose a stamped envelope for this list, to Mr. Alfred Vaughan, Verulam House, Oakfield Road, Penge, S.E.



## AMATEURS IN COUNCIL.

For "Instructions to Contributors and Correspondents," see page 46 of this Volume, or Part 13 (New Series), p. 46.

## Driving Emery Wheels.

C. F. WOLFE.—"I have much pleasure in telling Mr. WOLFE how I obtain 2,000 revolutions per minute for my emery wheel. My lathe, to which my emery wheel is fixed, is a heavy screw-cutting one with a 6 ft. bed and has a 27 in. flywheel; this length of bed enables me to keep my emery wheel well away from the fast headstock, mandrel saddle and slides, etc., and the large size of flywheel lends itself well towards the object in view, but the difficulty was, what sort of hand should be used to connect the flywheel with the pulley on the emery wheel spindle? Now, to tread at the rate of 100 revolutions of the flywheel per minute is not at all an unusual speed, the rate of treading depending, of course, on the amount of work done, but it will be found difficult to tread 200 times in a minute, even when doing no other work than tread; so given a driving wheel 27 in. in diameter, what diameter of pulley must we have to give 2,000 revolutions per minute at, say, 100 treads, this will be found to be about  $1\frac{1}{2}$  in. At such a high rate it will be found that a leather belt, even a thin one, will not lap round this small diameter closely, a considerable amount of 'slip' takes place, and, consequently, great loss of driving power; oiling the leather makes it more supple but does not improve matters. I then tried the 'tape' forming the loops by which boots are pulled on, and this answered better, but I wanted something wider, and this I found in 'belting,' a cotton material to be bought at the draper's, at from 1d. to 2d. per yard, and varying in width from  $\frac{3}{4}$  in. to 2 in. I enclose a sample, which, perhaps, the Editor will kindly forward you. The surface of this is dressed in some way that makes it very smooth, but this soon wears off, and the application of a little cobbler's wax, applied whilst the hand is in motion, gives it a splendid grip. I have used this 'belting' to drive an 8 in. by 1 in. emery wheel weighing about 5 to 6 lbs., driving from my 27 in. flywheel on to the naked spindle of the emery wheel, which is only  $\frac{3}{8}$  in. in diameter, with success; but I now drive on to a  $1\frac{1}{2}$  in. wooden pulley fixed with cobbler's wax to the spindle, and I can easily obtain from 2,000 to 3,000 revolutions per minute, and such a speed will be found

most useful for turning soft wood articles of moderate diameter. At first I used the wheel dry and found but very little dust from it. I was careful to thoroughly wipe the principal parts of the lathe, and I, so far, have not found any injury follow; but, at the same time, I would rather have the wheel mounted away from the lathe, if I could conveniently manage it, but I do not, at present, see my way clear to do this. I now use the wheel wet, moistening the surface continuously, but slightly, with a sponge held in the left hand, and find there is now no dust and the splashing is but little, it being easy to rig up a board to keep what splashing there is away from the lathe, and the tool is kept cool and the speed of cutting or grinding much increased. The hearings of the emery wheel spindle have not been packed or treated in any special manner to exclude the grit, and the spindle ends are polished beautifully and do not appear to have been abraded by any grit. In conclusion, I cannot too strongly emphasize the importance of driving the emery wheel at a sufficiently high speed, and I consider the ease with which this can be done to be mainly due to the use of this 'belting,' the ends of which are fastened by sewing.—EDW. J. SMITH." [If you will send me a stamped addressed envelope and refer to this reply, I will forward the sample.—ED.]

## Articles in "Amateur Work."

AMATEUR.—"How to Make a Beam Engine" (*Steam* was a misprint for Beam), and "How to Make a Model Locomotive," will appear in the present volume, but I cannot yet say in which Part.

## Model Locomotive Making.

J. WOOD.—I have a paper in hand on this subject which will appear in the present volume, but I cannot yet say in which Part.

## Preserving Leather.

CRISPIN writes:—"As I see an inquiry from D. W. B. (*Liverpool*), in *Amateurs in Council*, as to a preservative for leather, I may mention the best I have seen is a Russian preparation, called 'Thoplenogee,' the agent for sale of which is Mr. Boyd, Bootmaker, *Grand Parade, Cork*. A pot sufficient for three or four pairs of boots is sent by him, free by post, for 9d. (ninepence). It is a greenish oil, free from unpleasantness, and dries soon."

## Threshing Machine.

R. R. writes:—"In a back part I remember seeing a subscriber ask for instructions on making a threshing

machine, which I wish to endorse, as I could get all ironwork done very cheaply, and am able to make the woodwork myself. A machine of large size would be best." [I have no writer on my staff, at present, capable of giving such instructions, but your request shall be kept in mind.—ED.]

## Organ Building.

W. C.—Pneumatic action is not necessary, or, indeed, any improvement, in small one or two-manual organs, unless they contain very numerous and elaborate coupler movements, which in themselves are generally rather a source of annoyance than otherwise. In small organs the pedal pipes may be with advantage placed on pneumatic pallet, or made to continue a manual sub-octave coupler down to the CCC. I fancy the heaviness of touch is due to some simple cause which can be very simply removed. If W. C. will favour me with a drawing to scale, I shall have pleasure in advising and giving him drawing of suitable pneumatics, if needed.—J.W.H.

## Castings for Electro Motor for Driving Small Models.

R. H. C., F. S. S., and P. A. MULBROW.—The castings can be obtained from Mr. G. Bowron, Scientific Instrument Maker, 93, *Præd Street, London, W.*—ELECTRON.

## Re-Polishing Brasswork.

J. H. P.—Your brass articles that have been damaged by heat will have to be "dipped," and re-lacquered. An article on this subject appeared in the February Part, and in it you will find the information you require.—L. L.

## Self-Acting Fountain.

L. PAYNE (*Bridlington*).—I am unable to explain why zinc should be so much dearer at Bridlington than it is in London, or the difference in length of sheet. If you intend to make many fountains, it would pay you to order a few sheets from a wholesale house.—D. B.

W. P. MILLER.—I regret that a misprint of a 1 for a 4—not noticed in the author's proof—has misled you, but, at the same time, you ought not to have remained long in doubt, as in another part of the instructions the pillar is described as tapering from  $1\frac{1}{2}$  in. to  $1\frac{1}{4}$  in. at top. With reference to length of fret for tray, a strip the length of the zinc is 36 in.; this is more than enough for a tray  $11\frac{1}{2}$  in. diameter.—D. B.

## Astronomical Telescope.

AMENENHAT.—An easily-made telescope, of somewhat novel construction, was described in the last volume, page 402.



### Gas Check.

G. H. S. writes:—"Mr. Black, in December number, in describing his stop-short check for gas cocks mentions the 'matchless burner' with its drawbacks, but, perhaps, he and many of your numerous readers may not have seen a most ingenious little stopper—a full sized sketch is given in Fig. 1. It has stamped on it 'Breeden's Patent,' and is made of brass, and costs only 8d. or 9d. I have several in my house, and have also seen them much used in workshops, where they are called 'workmen's check valves.' I find one will repay itself in a week in saving of gas, etc. A sharp blow or push on the knob

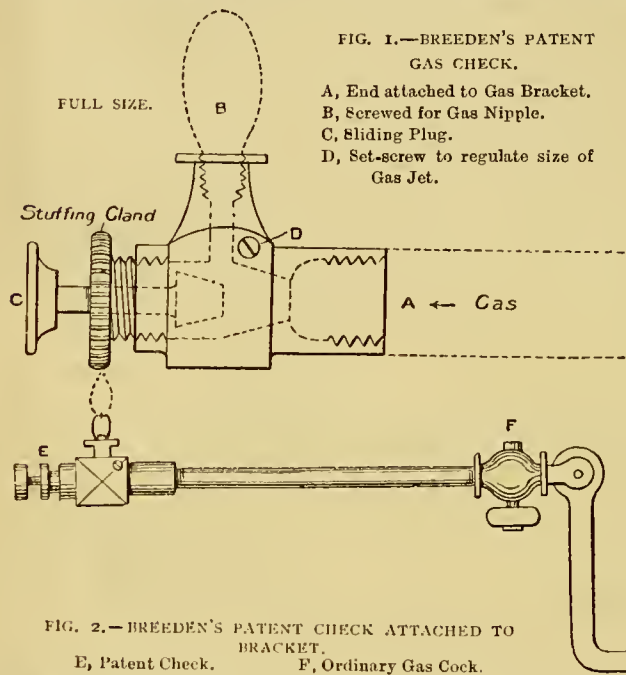


FIG. 2.—BREEDEN'S PATENT CHECK ATTACHED TO BRACKET.

E, Patent Check. F, Ordinary Gas Cock.

(marked C) will close the valve, leaving a small blue head of gas only on the burner (at B), and this head can be set large or small by a little screw (marked D). The knob can as easily be pulled out, instantly turning on the gas full. The ordinary gas cock remains as usual at other end of pipe, as in Fig. 2. I have also seen another form (I do not know if it is by same patentee or not) suitable for gas brackets with glass globes on, price 1s. each, with the movement sideways by a little lever hanging below and clear of the gallery holding glass globe."

[Messrs. Hulett and Co., 55 and 56, High Holborn, W.C., supply the Breeden Gas Checks at 9d. each.—ED.]

### Index and Supplements to "Amateur Work."

C. W. COOKE.—My own plan seems to meet your requirements, and is as follows:—I have the whole of the first seven volumes (which form a Series) bound in similar bindings, having previously taken out the folding sheets. I have duplicate indices of these seven volumes bound up together as a separate volume, so that I can find what I want without having to take several books from the shelves. You can get this extra index by ordering the November Part of each year and extracting the index therefrom. On each of the loose folding sheets I mark a conspic-

lum grinding, and also castings (rough or completed) of equatorial stand, as described in a former volume by Mr. Francis. If your readers refer to Mr. W. Harding, of 52, *Gladstone Road, Bournemouth*, they will receive every information they may desire as to specula grinding, silvering, etc. I have had numerous letters from him, and nothing could exceed his kindness in replying to my numerous queries. He knows all about the subject, and is most willing to impart that knowledge to others. He supplies perfect flats at a very reasonable figure, and the same remark applies to his stands. I have procured from him an excellent stand for a 11½ in. speculum. He will supply the castings in the rough or finished. I enclose my card, but, please, do not publish my name. You may, however, give my name and address to any correspondent who requires further information."

### Conjuring Apparatus.

ARTHUR HARLEY writes:—"Seeing in your Magazine, Vol. V., 'Some Hints on Conjuring Apparatus,' by Mr.



FIG. 1.—SHAPE OF TIN TUBE.

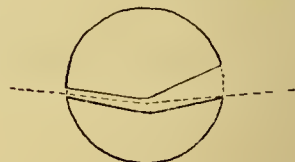


FIG. 2.—TUBE INSERTED IN ORANGE.

Adamson (the obedient hall catching my eye), I think that this trick can be performed with much more success by a little improvement." As every conjurer, amateur or otherwise, knows, a trick takes better when it seems to be impromptu. This is the method in which I do the trick:—After having performed the 'marked shilling found in the orange' trick, or a similar, in which the orange takes a prominent part, I take the remaining oranges, and ask one to be taken or chosen. Then, getting a piece of cord—the better plan is to borrow it of one of the audience—and a knitting needle, I push the needle through the orange and thread the cord through the hole, and it acts as well, or perhaps, better than the wooden ball. The secret lies in a small piece of tubing, made as in Fig. 1 (I use a part of a small

uous reference to the volume and page where the descriptive text is to be found; and thus marked, the sheets are put into a book letter-file (the sheets from four volumes in one file), which is then labelled and put into the bookcase. Perhaps others will report the methods they adopt.

### Speculum Grinding, Telescope Stands, etc.

T. L. M. C. writes:—"From time to time I have seen queries in your valuable Magazine relative to speculum grinding, and telescope stands, etc., and I am sure it would be of much interest, as well as profit, to your numerous readers to know where they can get valuable information regarding specu-

tin kettle spout), under pretence of threading the cord this is inserted in the hole, as in Fig. 2; the cord is then threaded through it, and it will be seen at a glance that this acts like Mr. Adamson's ball."

#### Electric Bell.

F. S. M.—The best appliance for ringing an electric bell from an ordinary door-pull is that known as Townsend's Variable Contact, made and sold by Messrs. T. Gent and Co., Braunstone Gate, Leicester. In this appliance a spring-bar is connected in line with the ordinary bell wires. When the bell-pull is drawn out, a pin on the spring-bar strikes a cam fixed to the upper part of a short pendulum, and sets this in action. The pendulum oscillates between two steel springs connected with one of the electric bell wires. The other wire is connected with the brass

The size would, of course, depend upon the space at your disposal. You may send in the article you mention on approval.—Ed.]

#### Shocking!

THE man who is shocked to death by electricity should be hurried in a volt.—*Texas Siftings*. Yes; it would be an appropriate place for his last ohm.—*Toledo Blade*. Since he is sure to dynamo.—*New York World*. Wire you so certain? he might offer you resistance.—*Electro-Mechanic*.

We intended to remark upon the shocking character of the above, but they came insulate that we are afraid they would scarcely pass current.—*Builder and Woodworker*.

The above battery of puns is in circuit in some of the more depraved American papers; although we are phonographic descriptions we draw the line at this.

#### Violin Making.

ANGLE.—You can get all materials and tools required for making a violin, of Mr. W. E. Hill, 72, Wardour Street, Leicester Square, London, who kindly undertook to supply readers of *AMATEUR WORK*. The most complete information upon the subject will be found in Vols. I. and II. (Old Series), *AMATEUR WORK*.

TEUR WORK. The articles referred to have since been published in book form, under the title, "Violin Making, as It Was and as It Is: Historical, Theoretical, and Practical." (Ward, Lock and Co.), price 10s. 6d.

#### Model Engine Building.

A. W. T.—"The Model Engineers' Handybook," by Paul N. Hasluck, published by Crosby Lockwood and Son, is an excellent work on this subject.

#### Tightening Lathe Band.

C. J. WOLFE (p. 46).—You have misunderstood my description of the above. My band is in one continuous length; one end is put over the double sheave from the front, and the other end from the back, the ends carried down, and under the mandrel pulley, and joined. The double sheave may be in one, or two sheaves fixed side by side.—*ELECTRON*.

#### Boot-Making.

LEATHER.—Materials can be procured of Lilly and Skinner, Paddington Green, W.

#### Conjuring Apparatus.—Chucking Penny in Lathe.

LEODIENSIS.—The easiest way to turn the groove in the rim is to fasten the coin to the face-plate in the usual way with cement. As, I imagine, you are not well up in turning, you will find it much simpler to saw the groove.—D. A.

#### INFORMATION SUPPLIED.

##### Truing Oilstone.

NIGGEE (*Croydon*), (p. 47).—The following method of truing an oilstone was given to me a short time since: Tack a sheet of coarse emery cloth on a level board or plank, which may be laid on the bench, and rub the stone till true.—*ELECTRON*.

##### Mildewed Lens.

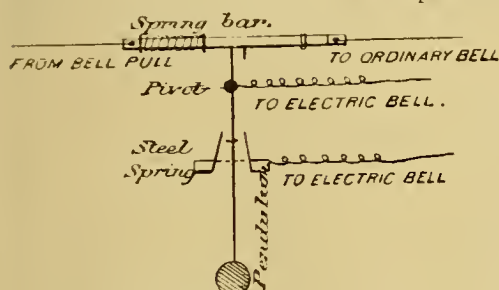
SEMPER FIDELIS replies to PHOTOGRAPHER:—"If this mildew does not interfere with the working of the lens, and is only the sheen of the balsam, better leave it alone. Keep lens in a warm place, but take care it does not get hot at any time."

G. W. replies to PHOTOGRAPHER:—"Some time ago, I had a pair of lenses which became mildewed, or cloudy, as I should call it, by allowing them to remain in the sun, which caused the cement with which they were fixed to run in between the glasses. I cured mine by putting in my glue-kettle, filling it with water, and gently heating until they separated easily. I then cleaned them and fixed together again, and they are as good as when bought. Perhaps this is the case with yours. I do not understand leuses, being a carpenter by trade."

##### Wood for Wood Screws.

G.W. replies to CLERICUS SECUNDUS:—"The wood mostly used to make bench screws and clamps is beech, which is hard and tough. I should advise C. S. to procure some pieces from a cabinet-maker's, as they have generally laid about a good time and got well seasoned, which is very essential."

SEMPER FIDELIS replies to CLERICUS SECUNDUS:—"The best woods for making these are those in which the grain is short and tough, such as poplar, holly, etc. I have made very good ones of beech, however. It is better to take off the wood in two instalments (technically cuts), if possible; but the boxes as they come from the shop are not capable of doing this, and the



RINGING ELECTRIC BELL FROM ORDINARY BELL-PULL.

bracket on which the pendulum is hung. The electric bell is set in action by contact of the pendulum with the springs on each side, and continues to ring whilst the pendulum touches first one and then the other, as it oscillates to and fro, but ceases when the pendulum is at rest. The idea is more clearly shown in the annexed rough diagram.—G. E.

#### Fitting up a Workshop.

J. A. T. writes:—"I am greatly pleased with the article on 'Fitting up a Workshop,' which is appearing in *AMATEUR WORK*; it is one that I have long wished for as I can obtain no satisfactory workshop inside the house where I am living. I think, however, there is room for an article of larger size and scope than the Rev. A. Thorold's promises to be; an article that would deal with the erection of a substantial and suitable workshop, and the appliances to be used therein." [You will have seen, as the article progresses, that it deals with a very suitable structure for the majority of amateurs.



cutter must be manipulated to take a slight cut first and a deeper and final one after. I intend cutting a bench screw from holly, in a short time, and will relate my experience. Whatever wood is used, it should be well oiled with linseed oil to keep it from warping. Some, however, think that this spoils the grip, but a bit of resin will cure this. The internal blocks are best of oak or tough ash."

### INFORMATION SOUGHT.

#### Reversing Frame for Whole-Plate Camera.

SEMPER FIDELIS asks:—"Would some reader kindly give sketch and measurements of above? Perhaps Mr. Parkinson will oblige."

#### Safety Bicycles.

OLD IRON writes:—"Mr. Stevenson, in 'Safety Bicycle Construction,' first proposed a brake on the rear wheel, and after defending it in 'Amateurs in Council,' seems to have reverted to the spoon brake on front wheel. If he does not propose giving the rear brake as well, in his excellent articles, perhaps he would kindly show how one could be fitted, detachable or otherwise, in addition to the front brake already provided, for occasional use when touring in very hilly country. Is there any form of cyclometer which an amateur could make without infringing patent rights? Perhaps Mr. Stevenson will help us in this also."

#### Photographic Studio.

N. P. A. asks:—"Would anyone kindly inform me whether a studio 8 ft. high, 6 ft. wide, and 16 ft. long, would be large enough for taking first-class portraits in; and should only one side be glazed?"

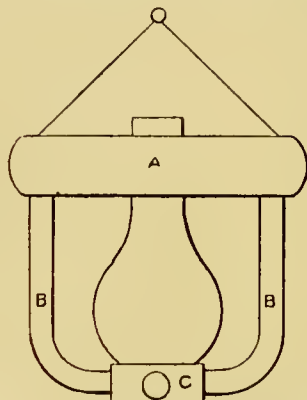
#### Spring Motor.

W. C. writes:—"I wrote to you about three years ago, asking for instructions for making spring motor; you then said you had not seen one, therefore could not give your opinion of it, but promised to see about it. I have since come to the conclusion that 'Puir Auld Scotland' was alike neglected by Press and Parliament, as no further notice of it has been taken. At last I minded that the 'Lord helped those who helped themselves,' in spiritual matters as well as worldly affairs. I therefore set about the construction of a motor on the clock-work model, and I have now a machine which will drive my organ for twenty minutes at one winding. The only drawback to it is the great weight required (200 lbs.) to

drive it. If I could get a spring powerful enough, it could be easily attached to the barrel, instead of the cord and weight; therefore, I will be greatly obliged if you will insert a query in the Council Column to the following effect: Wanted, to know where I can obtain a spring capable of exerting a medium pressure of 200 lbs. during 16 revolutions of barrel on which spring is wound; also price of same, and length and breadth of spring."

#### Hanging Lamp.

C. J. WOLFE asks:—"Can anyone tell me how to make an overhead lamp. I enclose a drawing, if the Editor thinks it will help to explain. A, a circular oil tank; B, B, conduit pipes; C, a circular burner with the air entering underneath. Would a lamp like this be safe, or would the oil flow too readily? I want one with the least fittings to



obstruct the light. Perhaps someone can tell me where to get one; a sketch would oblige."

#### Infernal Machine!

JACK THE GIANT KILLER asks:—"Can Mr. Edwinton, or any reader, tell me if it is possible to store up sufficient electricity in a tube the size of an ordinary walking-stick to paralyze a man's arm if discharged through it, and if so, how can it be stored, and how discharged?" [If "Mr. Edwinton or any reader" assists this bloodthirsty individual to make anything of this kind, I must ask him, in the interests of the other readers of AMATEUR WORK, to tell us, at the same time, how we may protect ourselves against any little experiments of the paralyzing kind that "Jack" may feel inclined to try.—ED.]

#### Covering for Dark Tent.

PHOTOGRAPHER asks:—"Could anyone tell me what is the cheapest and best covering for a dark tent. I want

something that will weigh light? Also, where to get the same?"

#### "The Violin."

S. M. L. writes:—"Will some of our musical readers kindly inform me if there is a new and enlarged edition of 'The Violin: Its Famous Makers and their Imitators.'—G. Hart. I have a copy purchased in 1876, but having lately heard that some three editions of this work are advertised, would like to know if mine is as complete as any. I may add that there are 351 pages, and about 500 wood engravings, mostly small, in my copy."

#### Half-Plate Instantograph.

WILL ELECTRON, or any other subscriber, help with the following:—"I have bought from Mr. Lancaster brass-work for above (1889 pattern). Could you kindly give sizes of wood-work? sketches would greatly assist. ELECTRON's answer to J. NISBETT in November Part does not apply, as that is what Mr. Lancaster calls his (original pattern).—W. L.

#### Address of Glass Manufacturer.

C. J. WOLFE asks:—"Will someone give me name and address of English glass manufacturer?"

#### Substitute for Paint Brush.

F. S. M. writes:—"Can any reader of AMATEUR WORK suggest to me any good way to make a small paint brush to use for a few moments and then throw away. In doing small jobs of painting, one often could do with a rough brush all that was necessary, and save the trouble of soaking out a regular brush each time." [How would it do to make a brush in the same way that a plumber does for applying muriatic acid, viz., by inserting the required number of bristles in the end of a piece of lead pipe and then closing the pipe on the bristles with a few blows of the hammer? Probably some ingenious reader can suggest something better.—ED.]

### ANSWERS DEVOID OF GENERAL INTEREST.

OLD IRON.—Thanks. It was an oversight. Glad to see you in the Council Chamber.

P. W. P.—See reply to ATHOS, p. 143.

### LETTERS RECEIVED UP TO FEB. 13.

OLD IRON; H. S.; LINELLE; P. BENNETT; WORKMAN; CO. CAVAN; J. JOHNSON; TOM WRIGHT; S. M. LLOYD; DYNAMO; CLERICUS SECUNDUS; D. W. B. (Liverpool); F. R. S. (London); J. J. PENSEOROW (South Africa); JEO. ROBERTS; A. BACK-PARLOUR SHOWMAN; WOULD-BE OROAN-GRINDER,





# A HANGING BRACKET,

By "The Mock Turtle"

For descriptive text see page 218



FIG. 1. Bracket complete

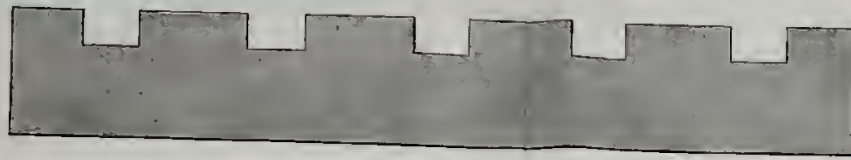


FIG. 8. Piece at top of Bracket Front.



FIG. 9. Pieces at top of Bracket Sides

FIG. 6. Section of shelf under cupboard shewing angle at which it is fixed

Full size

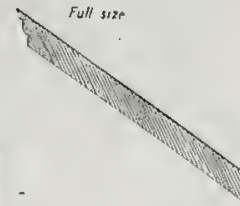


FIG. 3

Corners at A B Fig 2, and

B Fig 4

Full size

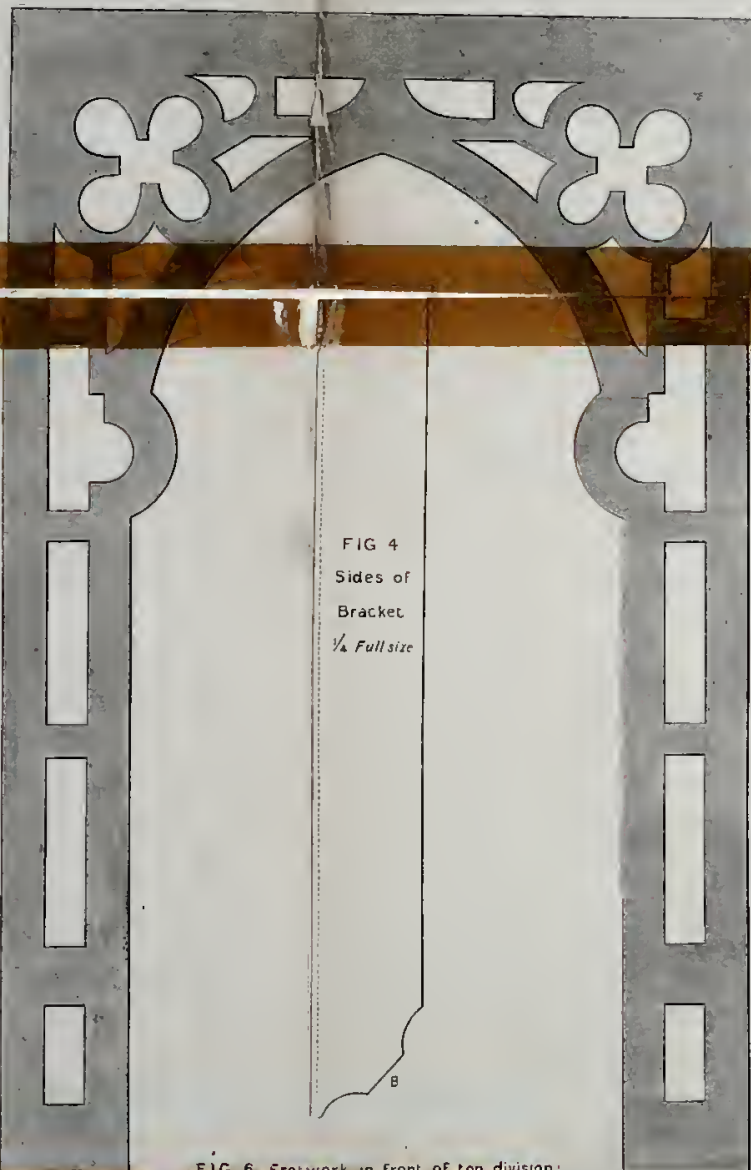
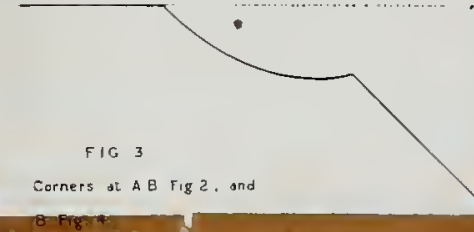


FIG. 4  
Sides of  
Bracket  
 $\frac{1}{4}$  Full size

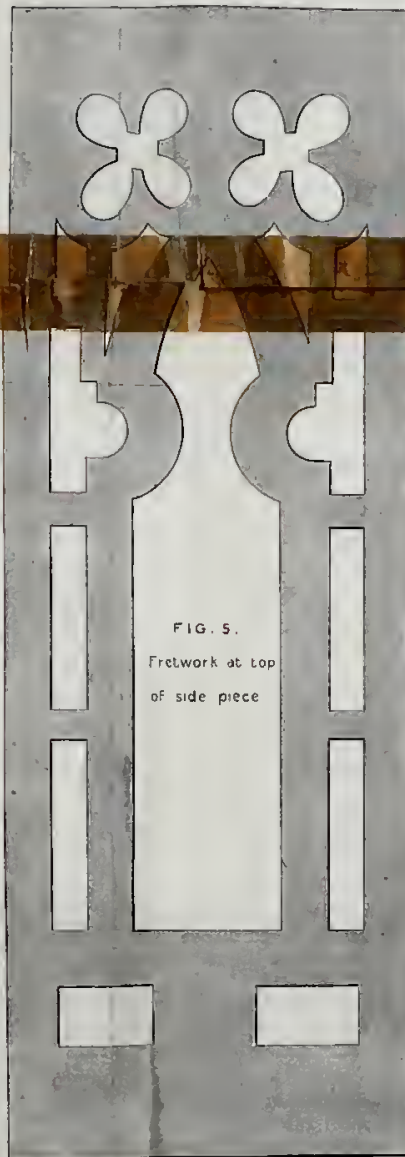


FIG. 5.  
Fretwork at top  
of side piece

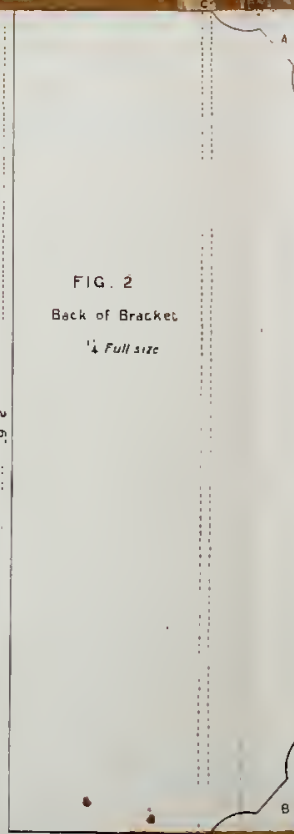


FIG. 2  
Back of Bracket  
 $\frac{1}{4}$  Full size

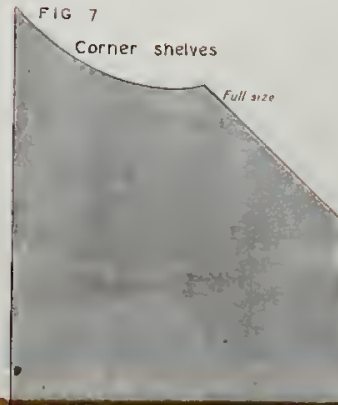


FIG. 7  
Corner shelves  
Full size

FIG. 6. Fretwork in front of top division







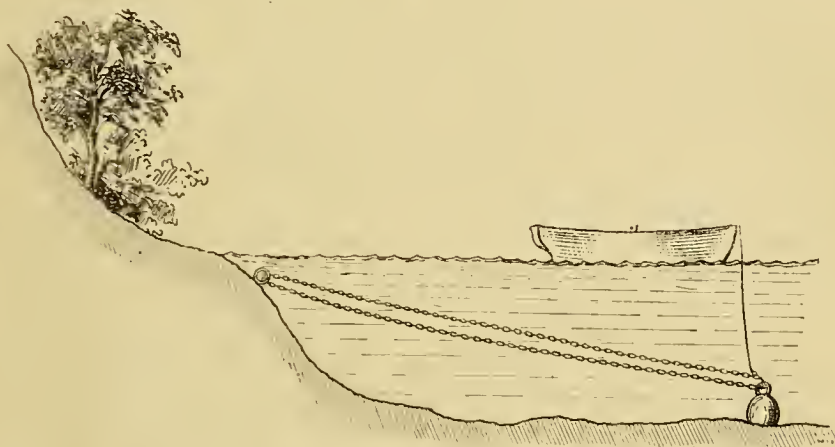
## SAFE AND SECURE MOORINGS FOR BOATS.

By EXCELSIOR, S.A.

**T**HE method of mooring boats described by Mr. Black on pages 49 and 188, Vol I., will not answer, for the simple reason that any boat so moored would swamp herself in a short time, with only an ordinary breeze. This would be brought about in the following manner.

Supposing the breeze blew towards shore, the boat would drift against the tightened chain, where she would at once chafe herself and most

50 feet long, then prepare your anchor, which may be anything heavy enough to stand the strain likely to be put upon it, now attach a good sized iron ring, about 9 inches in diameter and about  $\frac{3}{4}$  inch thick, to the anchor, pass the long rope through the ring, and drop the anchor at the proper distance from the shore. Splice the ends of rope very carefully, or tie them in a reef-knot, which will not be in the way, as it does not pass through the ring; at the junction attach another piece of rope (of smaller diameter than the long rope), which should be a few feet longer than the depth of water where the anchor is sunk; to the end of this rope the boat is fastened,



MODE OF MOORING BOAT SAFELY AND SECURELY.

probably knock the rudder to pieces if left shipped, as shown, the wind would then play upon the weather-side and raise that side and depress the lee-side, and before long she would get her lee-side under the chain, and expose a large surface for the next strong puff, the result would be that she would fill, and go down.

The plan I saw in use some thirty-five years ago in Tasmania, is quite safe from the effects of bad weather, but is no safeguard from a boat thief; and Mr. Black's plan is no safer, for "where there's a will, there's a way," as a Star Hack-saw would sever his chain in two minutes.

Supposing you wish to moor your boat 20 feet from the shore, procure a good rope 40 or

at the bow, not at the side, as shown by your correspondent.

The boat can then be hauled in or out by the endless rope, and she is free to swing to wind or tide, and will place herself in the very best position possible to meet the waves, viz., head to wind. The shore end of the rope can be attached to another smaller weight, and sunk a few inches below high water mark, as a safeguard against small boys. Fig. 1 shows the whole business, which, I should say, was invented hundreds of years ago; at any rate, ancient or modern, it answers the purpose required of it, and if anyone tries the plan during the coming season I shall be glad to see a report of its success in "Amateurs in Council."

## THE MYSTERY OF STATIONERY FORWARDING.

### ACCOUNT-BOOK BINDING.

By ALFRED BEAN.

I.—ORIGIN OF THE TITLE—DIFFERENCE BETWEEN LETTER-PRESS BINDING AND STATIONERY BINDING—TOOLS—MATERIALS—PREPARATION OF THE SHEETS AND INDEX—SEWING—CUTTING THE EDGES.



LANCING at the above perhaps somewhat ostentatious title—culled, by the way, from a copy of indentures in my possession—the uninitiated reader will, no doubt, be constrained to ask in what the difference may consist between the work of account-book binding and that of the art already so ably treated in *AMATEUR WORK*. He will, no doubt, be incredulous, when told of the antagonisms existing betwixt nearly every corresponding portion of the two structures. Such is, nevertheless, the case, as you will be enabled to judge from the ensuing description. One would imagine, indeed, that the creator of this mercantile adaptation of the art, if he ever existed as a distinct individual, had made it his business to study each little point in letter-press binding, for the mere purpose of preventing its introduction into his own work; for, from the first folding of the paper to the last touch of the finishing tool—for in this portion even of the work each branch has a style of its own—the two plans of action entirely differ. The true cause of this seeming contrariety lies in the uses to which the two classes of books are put; for, whereas the principle of construction for the library appears to be preservation and beauty, the accountant's desk must be provided with books capable of being easily written in. For this reason it is imperative that the ledger open up quite flat at the back; it is this condition, then, which causes all the multitudinous variations, and the combination of which, with the greatest strength and wearing power, forms the problem engaging the attention of every true artist in the trade, an object, also, to which your individual efforts must be directed.

In contrasting a specimen of each of the two branches the first difference you will notice will

be in the form of the two backs, that in the letter-press volume having only a slight curve compared with the other, which forms, you will observe, almost three parts of a circle. On opening the ledger you will notice, also, that the back, instead of opening with the book, as in the other volume, retains its shape, and forces the crease of the internal back with a slight spring upwards. Some years ago these backs were made of thin metal, but this material has now given place to the far handier substitute of millboard, saturated with glue. This difference in the pattern of the backs causes, also, variations in the other details. For instance, the boards, in order to allow the back to work freely, must be set at a moderate distance from it, thus causing the groove seen between these two parts. Leaving, however, the other diversities for consideration when dealing with the methods of construction, I will just run over the list of tools required.

The laying press, in a shop furnished with a cutting machine of any description, and binding exclusively stationery work, is seldom, if ever, used. Unless, however, you can secure the use of such a machine, the press, with its adjunct the plough (not the agricultural implement, but a modification (?) used for cutting paper), is inevitable. A small press, with pin, plough, and knife, and capable of dealing with a book 18 in. in length, may be obtained for 30s., *vide* the list of Messrs. Berry and Roberts, who, I may say, will also furnish you with all other necessities of the trade at reasonable prices. They may be addressed at 21, *St. Bride St., Ludgate Circus, E.C.*

In the absence of the laying press—and in its presence, too, if practicable—an upright press of some kind will be required. A clothes-press, or, much better, a copying-press, will, however, serve admirably for ordinary use, particularly if you can attach to it in any way a longer lever, in order to gain more power. A few pressing boards, the sizes of the books you intend producing, must be obtained. They should be made from very hard well-seasoned wood of about an inch in thickness, and they must have a perfectly level surface. A pair or so of cutting-boards of different lengths should also be



procured, if the cutting has to be done in the press; an end section of one of these is shown in Fig. 1. A few wooden rollers of different diameters will be wanted, but these may be obtained as rendered necessary by the thickness of your books, and will be particularized hereafter. The needle, shears, and hammer (round-faced) need no description, and the only remaining tools required are a glue-pot and brush, a paste brush, a knife, such as shoemakers use, and the folding stick, which is a kind of thick bone paper-knife, the stronger the better. This latter should have one end ground rather thin, and of the shape shown in Fig. 2. As to the materials: taking first the heaviest portion, viz., the boards, the best plan will, I think, be—supposing you do not intend using them in quantity—to get them of a large size, such as Royal or Imperial; they may then be divided into smaller pieces without causing much waste. In case, however, you wish to use the size suitable to the book, I may say that the boards are sold under the name of the size of book which they are more than large enough to cover. Nos. 1, 3, and 6 will be the most useful thicknesses. These, I should mention, are the numbers of the millboards; if strawboards are used (a kind of board, which, although cheaper, it is impolitic to use on account of its softness), the weight in pounds of the board (usually measuring 25 inches by 30 inches), should be given. In this case, the one, two, and three and a-half pound boards will be the most serviceable. As for the leather, Persian calf will, I think, be the most suitable, because it combines fair wearing power with ease of manipulation. Following this come the rough calf and the rough goat skins. If, however, a stronger material be required, red basil should be used, though this is rather more difficult to put on properly. Russia scarcely comes, I think, within the province of the amateur, being used almost entirely for the very heaviest books, and requiring, moreover, much skill in its successful treatment. For very small books, roan often forms the covering, though this material requires an expenditure of much care in order to keep it with its original lustre. Vellum may be used if cheapness be the

main consideration, and this substance, I may say, gives very fair results as regards wear, if not displaying any particular beauty.

The remaining materials consist of a yard or so of bookbinder's cloth, matching the colour of leather chosen, if possible; a little fine calico; a quire or so of marble paper, preferably the kind known as Dutch; and a few slips of vellum, or a yard or so of stiffened webbing—the latter in preference, it being more flexible than the vellum—as a foundation for the sewing, for which you will also require some three-cord linen thread. Glue—of the very best quality—and paste must, also, of course, be provided.

In the above list of tools and materials, the requisites for the marbling of the edges of the books are purposely omitted, as this process forms a distinct branch of the art, and need not be executed by the amateur unless desired. I propose, however, to give full instructions as to its acquisition, when the tools and materials used in that branch will receive separate attention. You will then be in a position to decide as to whether you will utilise the hints given, or allow the edges to be operated upon by the trade.

You will now, I daresay, have had enough of preparation, and, therefore, I will proceed with the work itself. You have the paper, ruled or otherwise, in readiness, of course. It should be double the size only of the leaf required, writing paper not permitting its folds to be crossed by others without serious protest in the form of an ugly wrinkle. The paper then, cut to proper size, should be placed in front of you on the table, the head of the sheets being nearest you. Take up five of these sheets, and after knocking the edges quite straight on the table, bring the right-hand edge over and place it perfectly even with that to the left; then, whilst holding it in place with the left hand, run the folder sharply down the bend. Repeat this throughout the whole number of sheets, using some discretion, however, when nearing the finish in order to cause an even division of the sheets into sections. For instance, supposing you have arrived within twelve sheets of the last, then, instead of continuing to fold in fives, thus causing a very diminutive section

at the end of the book, divide the twelve into three equal parts, making them into sections of four sheets each. If you purpose having an index inserted in the front of the book, the requisite paper (usually ruled feints only) should be folded separately from the other sheets, or you will find on opening the book that the index will be divided by leaves belonging properly to the body of the book. If it is intended to be what is technically called a "one letter index," that is, one furnished with a leaf for each letter of the alphabet, two sections of five, as in the book proper, and one containing four sheets will be required, thus making, when folded, an index of twenty-eight leaves; the two additional leaves being used in connecting it to the book and end-papers on either side. A greater or less ratio of leaves to letters I will leave to your own arithmetical powers.

You must now place these sections of five, or less, perfectly straight, with the folds towards you, and near the edge of the table. Hold them in place with the left hand, the thumb of which must upraise the folds of all but the lowermost division; then take in your right hand the folding stick, and rub down with the heaviest pressure possible this bottom fold. After this section is thoroughly flattened the next one above must be released and the folder be made to bear on the two, the same process being continued until the whole number are under the folder. You must then cut a couple of strips of calico the length of the book and an inch wide, and paste them around the folds of the first and last sections. A quarter of the width only should be allowed to lay on the side of the section intended to be placed towards the interior of the book, the greater width being put outside. A similar strip  $\frac{3}{8}$ ths of an inch wide should also be pasted down the centre of each of these outside sections.

When the calico is very nearly dry the book must be placed in the standing press, or between suitable boards in the laying press, using a pair of smooth millboards to separate the book from the wood. If the book is a very thick one, it should be divided in two or more parts by smooth millboards, the back of one division being

placed over the front edge of its companion. During the ledger's stay in the press, which should continue for a few hours, the end-papers and boards must be prepared for use.

For the former, take the two sheets which I told you (see "The Art of Paper Ruling," Vol. I., page 503), to leave unruled; also, a couple of waste or spoiled sheets, and fold each of the four singly. Then cut two strips of cloth the length of the book and  $1\frac{1}{2}$  inches wide, and glue each to the folds of a spoiled and clean sheet placed alongside each other. The proper order of doing this, after placing the glued strip in front of you, is to first lay the crease of the dirty sheet to the long centre of the strip, then that of the unruled sheet at about  $\frac{3}{4}$ ths of an inch from it. Now turn this combination over, and run the thin edge of the folder over the centre of the cloth along the crease of the first sheet deposited. Four pieces of marble paper must now be cut to the size of the half sheet, minus the width of the cloth, and be affixed with thin paste to the sides of the end-papers already garnished with the cloth, the verge of which the marble must cover. To complete the ends, they should be folded at the joint where creased by the folder, the decorated portion being placed inside.

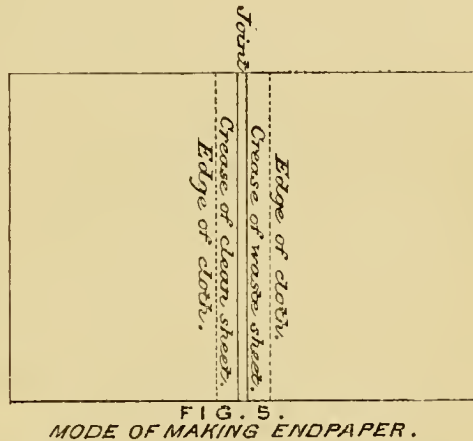
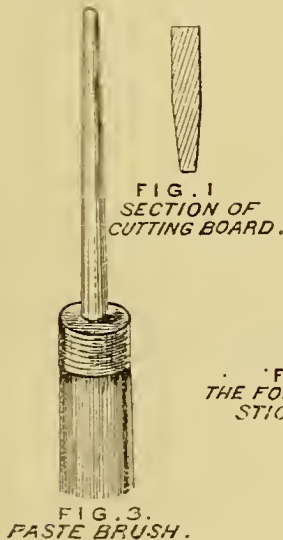
The board used on an account-book is, necessarily, as you will subsequently observe, made up of a combination of a heavy one and a lighter one at least, so that in getting them out you must not forget to allow for this. As a guide in choosing the boards, I may say that a foolscap 2 in. thick will require a coalition of Nos. 1 and 6, and from this you may, I think, calculate for any other size or thickness, adding, perhaps, the thickness of a No. 1 board for each increasing  $\frac{1}{2}$  inch in the book; a larger size, will, of course, require a correspondingly heavier board. In pasting them together, they should be secured across half the width only, if two boards merely are used; if another one is added, it should be pasted all over on the heavier of the half-united two. The portion unpasted is afterwards secured over an appendage to the book, as will further appear, to ensure greater strength.

The ledger may now be removed from the

press for sewing, its place being taken by the boards, in which position they should be kept until required by the book.

For the purpose of the sewing, a frame, though certainly very useful, is not in stationery binding absolutely necessary, as, instead of string being used for the connection of the sections, the somewhat stiffer vellum or webbing forms the foundation. The webbing should be cut into lengths about 3 inches longer than the thickness of the book; the vellum into slips the

cloth. It must then be taken back through its former exit, and also round the slip and into the interior of the end-paper again. This must be repeated at each slip, after circling the furthest of which the needle may be withdrawn at 1 inch from the further end of the leaves. Now take up one of the sections of paper, and after placing it even with the end-paper sew in the same manner—inserting the needle immediately over its last exit, without cutting the thread—as described for the outside leaves, omitting,



same length and 1 inch wide. Three or four slips of either will be sufficient for a moderate-sized book if placed at even distances along the length.

The proper position for sewing is to sit with the left side to the table, on which the unsewn book has been placed, with room in front for its gradual resuscitation there. In bringing this about take first one of the end-papers, place it clean side uppermost, with the fold to the edge of the table, and push the threaded needle through the joint at about an inch from the near end, leaving out 2 or 3 inches of thread. The needle must then be brought out against the position of the first slip, around which it must be passed, to be then reinserted through the

however, the circling of the slips, though before reinserting the needle at each of these it should be passed around the underlying thread. When brought out at the near end of the section the thread should be fastened securely to the projecting end immediately over which the needle should appear. The remaining sections are then sewn on similarly to the first with the exception of the twisting of the outlying thread at the slips. The thread, however, when brought out at the end of each section, must always be fastened to the loop connecting the two divisions immediately beneath. In sewing on the remaining end-paper, the operation of circling the slip must be again performed, combined with the twisting of the



thread. I should mention, also, that each section must be well pressed down whilst being sewn ; and that the thread, too, be pulled as tight as it is possible to do without throwing the book out of shape.

The book after sewing must be beaten at the back and head on a level table until perfectly straight at both places, when it will be ready to receive a coat of hot glue, which must be well brushed into all crevices between the sections, any neglected portion causing an ugly gap to appear when the book is opened on its completion. In mentioning glue, may I remind you that no more should be melted than is likely to be required at the time, as its power of adhesion greatly deteriorates with each re-heating.

After the "gluing-up," and whilst the back is getting dry, you may prepare for, perhaps the most trying operation to a beginner (if unable to secure a machine)—I mean the cutting. I must admit, however, that the greater portion of trouble occasioned in the practice of this is caused by the use of a blunt plough-knife. Be advised, then, and do not allow the knife to enter the plough until you are satisfied that the metal holds as keen an edge as it will take, when you may be assured that fully half the difficulty found in cutting will be removed.

When the glued back of the book is nicely set you may mark on one of the outside leaves the amount necessary to be taken off, denoting the same distance also on one of the cutting boards, measuring from the broadest edge. This edge must then be placed even with the fore-edge of the volume on the unmarked side. Another board must then have its same edge placed to the marks on the book, which, with its embracing boards, must now be placed in the press, the edge of the unmarked board and the marks on the other being even with the top of the press, and the latter board being on the grooved side. Screw up as tightly as possible, then set the plough with the point of the knife just touching the protruding paper, the opposite side of the instrument being deposited in the groove formed on the press for its reception. Now draw the plough steadily backwards and forwards along the press, taking hold of the ends

of the screw for the purpose. This screw, at each stroke of the plough, should be very slightly turned in order that the knife may make a deeper cut ; too much turn, however, should not be given, or the resulting edge may perhaps furnish you with one explanation, at any rate, of the identity of names claimed by two seemingly utterly remote instruments, viz., the agricultural and the bookbinder's plough.

The fore-edge being cut, must be furnished with a covering of some kind as a protection from, or rather, perhaps, a concealer of, dust. The simplest method of doing this is to sprinkle on it a red or blue dye in fine showers, from a brush furnished with stiff bristles, which, being knocked against a stick or ruler, give forth the contained colour. This method being, however, hardly suitable to a stationery book, I propose to give you some instruction in the process of marbling, which important subject, however, surely deserves a commencement in another chapter, to which it is therefore deferred.

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## SAFETY BICYCLE CONSTRUCTION FOR AMATEUR MECHANICS.

By A. STEVENSON.

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### IX.—RULES FOR GEARING—WHERE TO BUY PARTS— LADY'S SAFETY BICYCLE.



**PURPOSE** in this, the closing paper of the series on this subject, to say a word about the gearing of these machines. By gearing, I mean the speeding up of the 30 inch wheel to equal the large wheel of the ordinary bicycle. A tall rider, say, six feet, and having a good length of leg, would require (if using an ordinary bicycle) a wheel perhaps 60 inches diameter ; one complete turn of this wheel would propel him 15 feet or thereabouts. Mount the same man on a Safety ; one complete turn of the pedal shaft would only propel him 15 feet, provided the 30 inch wheel was geared double, that is to say, the wheel would make two complete revolutions for one of the pedal shaft, and this is effected only by the gear wheels driven by the chain. It will, I think, be self-evident that if you put a nine-tooth cog on the hub of the 30 inch wheel, and

an eighteen-tooth cog on the pedal shaft, every turn of the eighteen-tooth cog will be two of the nine-tooth, and the machine is, consequently, geared double, the 30 inch wheel is equal to a 60 inch, and the two machines running together go at the same speed with the same pedalling.

I will here give a simple arithmetical rule to reckon the gearing up by the teeth of the two cogs.

Multiply the diameter of the driving wheel by the number of teeth in the chain cog on the pedal shaft, and divide the result by the number of teeth in the hub cog; the answer will be the speeded up diameter of the wheel in inches. For example:—

|                      |     |     |                  |
|----------------------|-----|-----|------------------|
| No. 1. Driving wheel | ... | ... | 30 inches        |
| Pedal cog teeth      | ... | ... | 18               |
|                      |     |     | <u>240</u>       |
|                      |     |     | 30               |
| Teeth in hub cog     | ... | 9 ) | 540              |
|                      |     |     | <u>60 inches</u> |

In this example the machine is speeded double. It does not matter how many teeth each of the two cogs may have, provided the one has double that of the other. Another example:—

|                      |     |     |                                          |
|----------------------|-----|-----|------------------------------------------|
| No. 2. Driving wheel | ... | ... | 30 inches                                |
| Pedal cog teeth      | ... | ... | 16                                       |
|                      |     |     | <u>180</u>                               |
|                      |     |     | 30                                       |
| Teeth on hub cog     | ... | 9 ) | 480                                      |
|                      |     |     | <u>53<math>\frac{1}{3}</math> inches</u> |

|                      |     |     |                                          |
|----------------------|-----|-----|------------------------------------------|
| No. 3. Driving wheel | ... | ... | 32 inches                                |
| Pedal cog teeth      | ... | ... | 14                                       |
|                      |     |     | <u>128</u>                               |
|                      |     |     | 32                                       |
| Teeth of hub cog     | ... | 9 ) | 448                                      |
|                      |     |     | <u>49<math>\frac{2}{3}</math> inches</u> |

|                      |     |     |                                          |
|----------------------|-----|-----|------------------------------------------|
| No. 4. Driving wheel | ... | ... | 30 inches                                |
| Pedal cog teeth      | ... | ... | 14                                       |
|                      |     |     | <u>120</u>                               |
|                      |     |     | 30                                       |
| Teeth of hub cog     | ... | 9 ) | 420                                      |
|                      |     |     | <u>46<math>\frac{2}{3}</math> inches</u> |

Now, if you mounted four riders to run in a race with machines geared as these four examples, and started them at scratch, if they all pedalled at the same speed, No. 1 would at

once take the lead, while No. 4 would at the same time fall behind, the other two taking intermediate places, while the machines, to an uninitiated spectator, appear to be alike.

It would appear from this that the high-gear machine has the best chance in a race, as, indeed, it has if the rider has the stamina to drive it, for it must be observed that the higher the gear, the greater power is needed to drive the machine. No. 2 would be easier driven than No. 1, No. 3 than No. 2, and No. 4 easiest of all. No. 4 will pedal easier, consequently, faster, than No. 3, and so on with the others, and in a race, such as proposed above, it would be no surprise to see No. 4 come in first, and No. 1 last. The man who has the grit is likely to be the winner in such a contest.

For ordinary use or touring, and where a high speed is not a desideratum, gear No. 3, or even No. 4, is much to be preferred to higher gears. With No. 4 you could mount a hill without difficulty, while if you tried it with No. 1, you would have to "get out and walk."

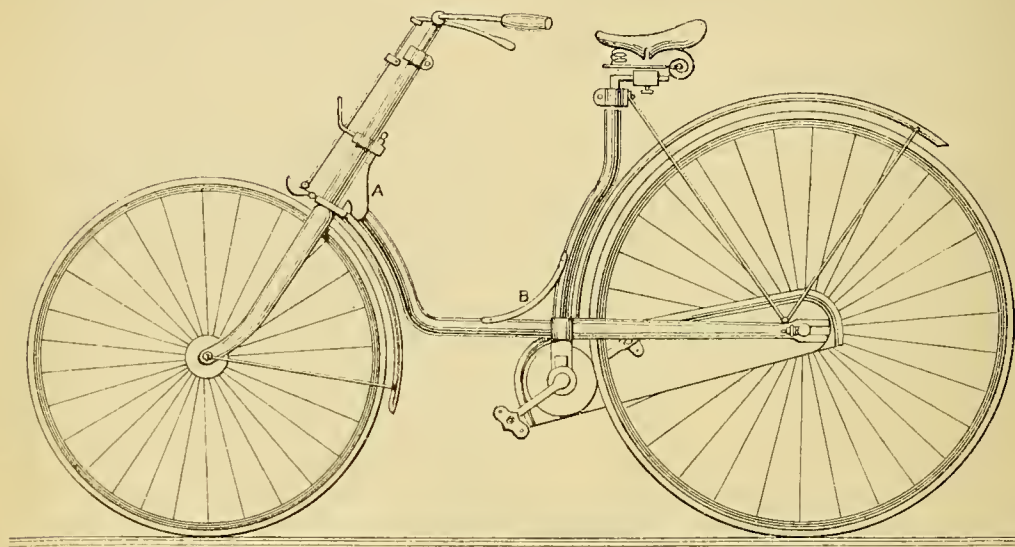
For the benefit of those who undertake to build their own Safety, and wish to avail themselves of the information, I have to mention that all the parts, either finished or in the rough, may be bought of several respectable dealers or makers, among others, Henry Matthews, *Snow Hill, Birmingham*; J. Devey, *Berwick-on-Tweed*; W. A. Lloyd, *Weaman Street, Birmingham*; either of whom will send price-lists of their materials and fittings. I have dealt chiefly with Lloyd and Devey, and have been very well served by both. I should advise that hubs and other bearings be bought finished and plated, as well as cranks and pedals. The handle-bar and brake work may also be bought finished and plated, or, if finished by the maker himself, they should, in any case, be plated, as it is a great set off to a machine.

The amateur Safety maker, in furnishing his machine with saddle and spring, must consult his taste and comfort, or possibly his purse, as these articles range in price from about 2s. 6d. to 15s. The only other accessories are tool-bag, wrench, oil-can, spoke-grip, and, for night riding, a lamp.

Accompanying this paper is a drawing of a Lady's Safety Bicycle, showing that these machines, with a little alteration in the construction of the frame, may be ridden with propriety and grace by ladies. The chief feature in the construction of the frame is the lowering of the backbone, and a reduced diameter of the steering wheel. I have made several machines of this form, and always with the front wheel reduced to 26 inches. My reasons for this reduction are, first, it is, I think, handier to steer; second, it is lighter; third,

respects, the lady's Safety is similar to the gentleman's Safety, the build being, perhaps, a little lighter, and the instructions attempted to be conveyed in these papers to build a Safety Bicycle, will serve equally for the building of the lady's Safety. A dress-guard of leather covers the chain and chain-wheel.

I have, for the present, to take leave of all friends who may have read these papers, and hope that those who have been stimulated to enter upon the task of building their own machine will have found some help from them.



LADY'S SAFETY BICYCLE.

the rim of the wheel is further forward out of the way of the dress by a couple of inches, while the wheel centres and the position of the handle-bar remain the same.

The direction of the rear fork and part of the backbone is level, then the backbone curves upwards over the front wheel. The neck piece, A, should have the tenon, or part that enters the tube, drooping as for an ordinary bicycle, so that the backbone may follow the curvature of the wheel, and about half an inch clear of the mud-guard. A short curved stay, B, is brazed on to the backbone and front of seat tube. It is made from a piece of crescent rim stuff, and serves to stiffen the frame greatly. In other

As to those who only read, they will lose nothing, but gain at least some theoretical knowledge of the construction of the popular Safety Bicycle.

THE PANELS OF DOORS and windows afford suitable objects for decoration and offer unlimited scope regarding the choice of subjects, which may range from a simple flower spray to a highly finished land or sea scape. The design may be in monochrome in contrast of light and shade or include the full range of the palette. Landscapes with water, and tall slender figures are well adapted to panel pictures.—*Builder and Woodworker.*



## FOUR USEFUL WRINKLES.

By EXCELSIOR, S.A.

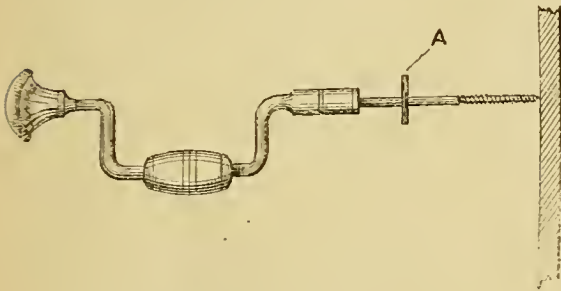
## CUTTING GLASS BOTTLES.



HAVING tried a dozen different methods, I was recently told of the following plan, which is the best I have yet tried:—Procure a piece of iron wire and bend it into a simple loop, heat it to a bright red, slip over the bottle to the right spot, and then pull opposite ways, your top is off in a crack.

## BORING HORIZONTAL HOLES TRUE.

I HAVE found this plan very useful when boring



BORING HORIZONTAL HOLES TRUE.

holes in posts, or when the hole is required to be at exact right angle to the vertical line. Slip a washer, A, on to the shank of the bit, and watch it; if it travels from you, your brace handle is too high; if it travels towards you, your handle is too low. It must (during the revolutions of the bit) remain in the same spot. The washer must be free from burrs, and, if turned, will be all the better.

## CUTTING SCREW-THREADS IN HORN, VULCANITE, LEAD, ETC.

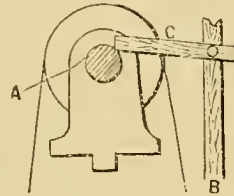
THE following wrinkle will be found useful by many of your readers who may be engaged in electrical work, or by those who have occasion to repair vulcanite brooches or ornaments; it may also be used with copper, soft brass, white metal, and many other substances:—Procure two ordinary iron screws, used for woodwork, they must be the same number and size. Place one in a vice and file off three sides, which will convert it into a tap. Bore a suitable hole, insert the tap, which will cut a clean thread in

any of the above substances, withdraw it and insert the other screw, which will hold anything very firmly.

## TURNING TO EXACT SIZE WITHOUT CALIPERS.

A FRIEND of mine, recently returned from a tour in America, informs me that in several turning shops he saw the following plan adopted for turning a number of articles to exact size:—

Upon the tool tray behind the head and tail stocks, two small wooden uprights were fixed, their height about 1 inch above the centres; at the exact height of the lathe centres a hole was bored in each upright, about  $\frac{3}{8}$  in. diameter. A  $\frac{3}{8}$  inch iron rod was passed through these holes, parallel to the lathe bed, and upon this rod small pieces of wood of various lengths (having a  $\frac{3}{8}$  inch hole at one end) were slipped, one of these small pieces, of a suitable length, was turned over and rested upon the article



TURNING TO EXACT SIZE WITHOUT CALIPERS.

Section above Lathe Bed. A, Work fixed between centres B, Upright; C, Piece of wood acting as guide.

being turned, and when it was sufficiently reduced the small piece immediately dropped. The sketch will show it very clearly.

PARLOUR ELECTRICITY.—A very simple apparatus for obtaining an electric spark is made by a German physicist. Round the centre of a common lamp chimney is pasted a strip of tin-foil, and another strip is pasted from one end of the chimney to within a quarter of an inch of this ring. Then a piece of silk is wrapped around a brush, and the interior of the chimney is rubbed briskly. In the dark a bright electric spark may be seen to pass from one piece of tin-foil to the other each time the brush is withdrawn from the chimney. Many other experiments can be tried with this apparatus.

## AMERICAN ORGAN BUILDING.

By THOS. L. WINNETT.

III.—DESCRIPTION OF REED-BOARD—FIXING—PALLETS—  
PLUNGERS—MUTES—KEY-FRAME BEARERS—SWELL  
COVER AND SHUTTERS—KEY SLIPS—ATTACHING  
PLUNGERS TO KEYS—REGULATING KEYS.



In the last chapter we had the bellows and soundboard placed in position in the skeleton case. The soundboard must now be fixed permanently in the grooves, either by gluing the ends, or by jamming it tight in and fixing a small block at either end to prevent it slipping backwards or forwards; but I should not pursue the latter plan if the board fits tight in the grooves.

We now come to fixing the reed-board on the top of our frame (Fig. 19 in last chapter). I will presume that you have already obtained the reed-board from Mr. Marsh, whose address I gave in the last chapter, and that it is a three-row board, and room for separate Sub-bass at the back. I will give a brief description of this board as supplied by him. It consists, in the first place, of a flat jointed board, made of beech, 21 in. broad, 3 ft. long, and  $\frac{5}{16}$  in. thick. On the top of this, near the front edge, you will find fixed the reed cells, or cavities filled with reeds, two rows one above another at the front, and one row at the rear. The front row contains, at the bottom, one full set of sixty-one notes, 8 ft. tone; these are the Diapason and Melodia reeds, and will have those names attached to the stop handles. The top row, front, contains a set of sixty-one notes one octave higher, and are the Principal and Flute stops. At the rear are sixty-one reeds, but the top half are of 16 ft. tone (Violoncello) in the treble, and the other half a soft 8 ft. for bass (Dulciana). I need not spend time and space in describing what is meant by 4, 8, and 16 ft. tones, as the matter has been so often explained in these pages that we should by this time be quite conversant with the subject. The Sub-bass reed box will be described and fixed later on.

The first thing to do with our reeds is to mark the side of frame (Fig. 19) which we intend to form the front of the organ. Then lay the reed-board carefully on the top with the reed cells to

the front. When we are sure of the position, mark the place with a pencil, and glue well all the edges of frame and reed-board with best glue, boiled up for the first time for this job. Place it again in position by means of the pencil marks, and press the two parts together with a few cramps, if we have them. If not, we will drive in about a dozen wooden dowels from the top to fix the two parts firmly together. Do not use screws on any account, unless they are very small ones, and even then they must be taken out when the work is dry, and wooden plugs inserted in the holes. Put the reed frame away for a few hours for the glue to set; when dry, the board must be trimmed neatly round the edges, and examined to see if we have left any cracks between the frame and reed-board. The remedy for this will be to run hot glue into the joint from the inside.

Now lay the frame on the soundboard in the case, leaving  $1\frac{1}{2}$  inches at each end. If we have done our planing well, the reed frame should bed down on to the board without any serious cracks showing. Strips of wash-leather of an even thickness must now be glued to the underside of the frame, to make it fit perfectly air-tight all over when screwed down. This done, we may proceed with the screwing down. We shall want fifteen  $2\frac{1}{2}$  inch round-head screws (No. 14), and fifteen brass washers. The holes are to be bored right through the reed-board and frame, and must be of the same gauge as the screws. There must be four in the front, four at the back, and three on either side (see Fig. 20). A smaller gimlet must be used to continue the holes partly through the soundboard. You will easily see that the screws must fit loosely in the frame, and take their hold only upon the soundboard. This will, of course, draw the two parts together. Be very careful to keep the centre-bit perfectly upright when boring, else the screws will not bed down properly. The fifteenth screw is to be placed in the centre of reed-board, to give support to the middle. A block will have to be made exactly the same height as the sides of frame ( $1\frac{3}{4}$  inches), leatherned underneath, glued to the top, and bored for screw. You can now, if you like, screw down, just to see if it fits all

right, but it must come off again in order to fit the pallets.

Take out all the reeds in the front bottom row, keeping them in the exact order for replacing, and glue a strip of cloth or red felt, 2 inches wide, on the reed-board, just in front of the cells, and close up to the holes. The object of this is to keep the air from rushing under the reeds instead of through the proper channel at the top, thus causing a great waste of power. Replace the reeds when the cloth is *nearly* dry, and see that each one fits properly over the edge of the cloth. Treat the other rows in the same manner. The top row, front, of course, will only require a narrow strip.

You will have observed on the underside of reed-board, sixty-one long slits cut; these are the valve holes, each one of which has to be covered with a strip of leathered wood, called a pallet. Fig. 21 shows one fixed in position. Each pallet is acted upon by a plunger or tracker pin (c, Fig. 20) when a key is pressed down, the spring, e, bringing it back to its original position as soon as the key is released.

Mr. Marsh supplies these pallets, as well as other small work, at a very low price, 9d. per set of sixty-one. The valve pins (c, Fig. 20) can be obtained at 6d. per set, and, of course, fit the pallets. These pins I made myself out of ordinary needle points, but as there is not much real economy in it, I would not advise anyone to do the same; the steel points, also, I have found, are liable to rust, resulting in the sticking of the pallet. The springs (Fig. 21) you had better not attempt to make. They may be had for 1s. per set, far superior to anything we could make, although I have turned some decent ones out of stout piano wire. As it is not worth while to spoil this part of the organ for the sake of a few pence, I should advise (unless you are possessed with a laudable desire to have the whole organ your own work) that these few necessities in the way of small work should be bought, rather than spend the time in making them yourselves.

If, however, you decide on making the pallets yourself, I will endeavour to show you how it may be done. Take a  $\frac{1}{2}$  inch deal plank, per-

fectly dry and free from knots, plane the edges square, and at a distance of 7 inches from the end, with a T square, run a pencil line across it, and cut off. Plane the end square again and cut off a similar piece. Supposing our plank to have been 6 inches wide, we shall want six pieces cut off, all exactly 7 inches long. Now take the reed-board, turn it upside down, and over the valve holes lay our six pieces side by side so that the grain of every piece runs the same way as the valve holes, and leaving between each piece the width of a saw-cut. Presuming that we have cut them all the same length, and that the ends are all in a straight line, draw two pencil lines right across from end to end  $\frac{3}{8}$  inch from each edge across the grain; these lines to mark the place where the ends of each pallet are to be bevelled. Figs. 21 and 22 will explain what I mean. Now slip the six pieces back a little so that the end of valve holes appear, and with a pencil carefully mark off the width each pallet is to be. Number each one as you go on, beginning at the bass end so that we may not lose their position, and cut through with a tenon-saw. Finish each pallet off with sand-paper neatly, and make two saw-cuts in each end (A, Fig. 21) to take guide pin, B. We shall next want a strip of beech or some hard wood for a guide slip (Fig. 23). It must be strong, to bear the pressure of sixty-one springs, and must measure 34 inches long, 1 inch wide, and  $\frac{5}{8}$  inch deep. Plane it up true, and glue on to the underside of reed-board,  $7\frac{3}{4}$  inches from the front, in the position shown at F, Fig. 20, and fix with three or four small screws. A very good dodge for this guide slip is to get a short length of 1 inch plain oak moulding sold by picture-frame makers, and cut off the rabbet.

Each pallet must now be covered on the underside with a strip of soft leather. Wash-leather, if it can be obtained of an even thickness, is a good thing for the purpose, and is not very expensive. The simplest way to set to work is to glue the underside of each pallet separately and stick them side by side on the piece of wash-leather; they can then be cut out with a sharp knife or a pair of scissors when dry. The leather immediately round the saw-



cuts in each pallet must be eased a little, so as not to impede the working on valve pin. Replace them all in position over their valve holes and drive in the valve pins, boring the holes first with a very fine bradawl. Keep each valve pin perfectly upright or the pallet will not work properly. When we have made them all



FIG. 22.—SHOWING HOW PALLETS ARE TO BE CUT.

seasoned as that which manufacturers use for the purpose.

The next thing to do is to make sixty-one plungers (Fig. 26). These are simply pins made of cedar wood, and by means of which the valve is connected with the key. Mr. Marsh sells plungers at 1s. per set, and as they are made to fit the collars supplied with the Octave Coupler, I should certainly advise you to get them ready-made. They are a great trouble to make satisfactorily straight. Try every pallet, by pushing down the plunger, to see if it works evenly and silently. If we are satisfied of this we may screw down the frame to the soundboard permanently.

Now, if you have not already discovered the

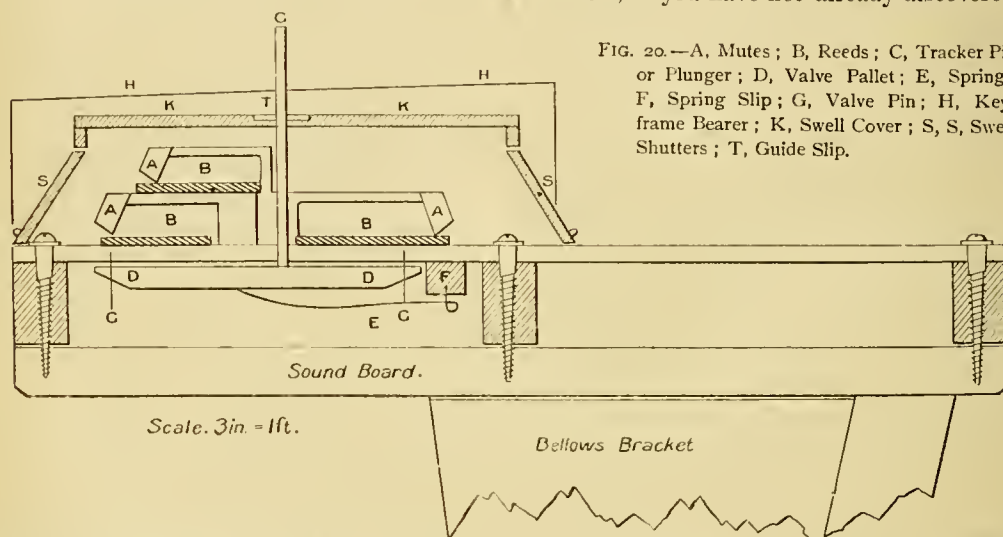


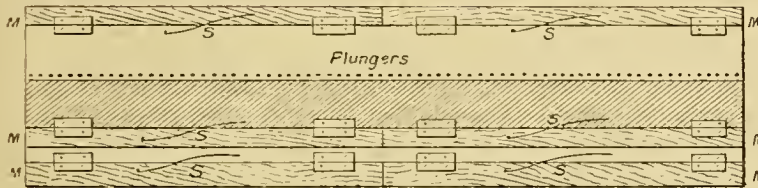
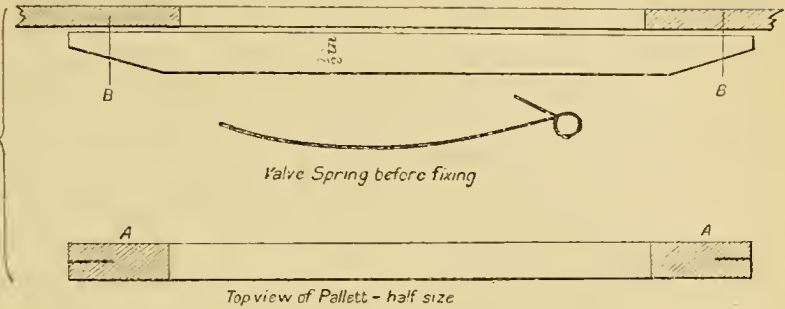
FIG. 20.—A, Mutes; B, Reeds; C, Tracker Pin or Plunger; D, Valve Pallet; E, Spring; F, Spring Slip; G, Valve Pin; H, Key-frame Bearer; K, Swell Shutter; S, S, Swell Shutter; T, Guide Slip.

work easily on their pins, we may fit the springs. Bore sixty-one holes with a fine bradawl in the top of guide slip, in the position shown at Fig. 23. Each hole must be *exactly opposite the centre* of each pallet. Insert the short ends of the springs in the holes and tap down with a hammer, taking care that the end of each spring comes in the centre line of pallet. This completes the pallet work. Some manufacturers size and varnish all the inside of reed-board and pallets to preserve the wood, but I do not think it is necessary, although, of course, it looks nicer, and is, perhaps, a precaution against leakage through any crack which may afterwards be inclined to start, for our wood cannot be so well

fact for yourselves, you will have the supreme happiness and satisfaction of being able to make the reeds sound by blowing the bellows and pushing down a plunger. This, of course, causes a reed in each of the three sets to vibrate. In order to make each set sound separately we must cover the entrances of each row with a strip of wood called a mute, the opening and closing of which is controlled by a stop. The comparative sizes for the different sets are given in Fig. 24, in the position they are to occupy on the reed-board. They must, of course, be of the same length as the set of reeds and divided into two parts somewhere about the centre between the notes B and C, in order to separate the bass

FIG. 21.  
Valve Pallett  
Half size.

A. Saw cut.  
B Valve pin.



M. Mutes.  
S. Springs.

FIG. 27.  
Topview of Cavity Board,  
showing Mutes and Springs.



FIG. 27 a  
Back Key slip  
Half size

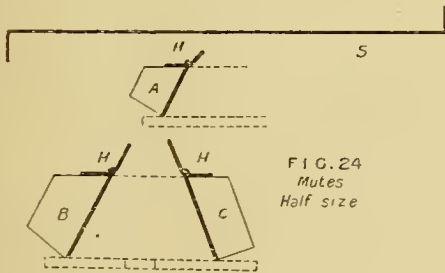


FIG. 24  
Mutes  
Half size

A Mute for upper row, front  
B do - lower - do.  
C do - back row  
S Springs to close mutes  
H Hinges

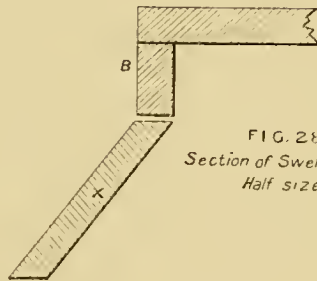


FIG. 28.  
Section of Swell Shutter  
Half size



FIG. 23  
Guide Slip and Spring.  
Full size

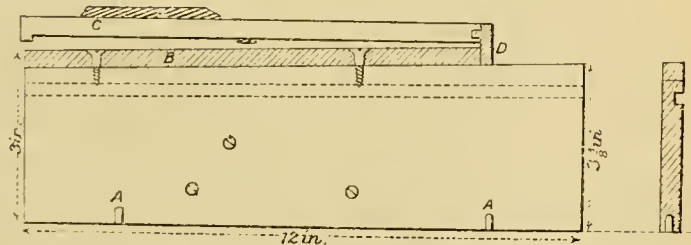


FIG. 25.  
Key frame bearer  
Scale 3 in. = 1 ft

A Key frame bearer.  
B. Key frame  
C Key  
D. Back key slip.

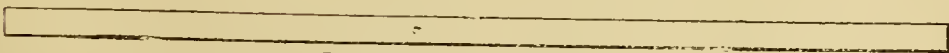


FIG. 26. Valve pin. Full size

from the treble. Each half is to be hinged to the top of its own set of reed cells by a piece of broad black tape and two small brass hinges, and is kept closed by means of a spring made out of a piece of stout piano wire  $5\frac{1}{2}$  inches long. Bend it into the shape given at s, Fig. 24, fixing one end in a hole perpendicularly made in the top of mute, and then springing the other into a similar hole made in the top of cavities to which the mute belongs. Fig. 27 shows a top view of cavity board with mutes and springs fixed. This will, perhaps, explain the matter in a clearer way than I can do by means of words.

Next prepare two pieces of wood for key-frame bearers (A, Fig. 25),  $\frac{3}{4}$  in. thick, 12 inches long, and  $3\frac{3}{8}$  inches high at one end, sloping down to 3 inches in the front. These two pieces are to be placed upright on the reed-board at each end of the cavities, with a distance between them of 33 inches. They must be fitted into their places by means of dowels driven into the cavity board; two dowels to each bearer, in the position shown in Fig. 25, in order that the bearers may be lifted off at any time we wish to get at the action. At a distance of  $2\frac{1}{2}$  inches from the bottom cut a groove  $\frac{5}{16}$  of an inch deep and  $\frac{1}{2}$  inch wide across each bearer on the inside parallel with the bottom edge; this is to take a swell cover made of  $\frac{1}{2}$  inch stuff  $9\frac{1}{2}$  inches wide, and 2 feet  $9\frac{5}{8}$  inches long. This should, when put together, leave exactly 2 feet 9 inches between the bearers. Glue the swell cover in the grooves. A strip  $\frac{3}{4}$  inch deep must be glued on to the front and back edges of the swell cover, 2 feet 9 inches long and  $\frac{1}{2}$  inch thick, for the swell shutters to fit against (B, Fig. 28). The shutters are to be of the same length as the swell cover, and to fit loosely between the bearers. Make them of  $\frac{1}{2}$  inch deal, about  $2\frac{1}{2}$  inches wide, bevelled at the top and bottom edges like Fig. 28, and which edges must be covered with felt to silence the working, and to more effectually keep the sound in when the shutters are closed. Pivot at each end by inserting a pianoforte key pin to work in bushed holes in the key-frame bearer. The position of pivot is shown by the cross in Fig. 28. The swell shutters need not be divided in the middle for treble and bass like the mutes, unless

we wish to add a stop to act upon them separately, as they will both be controlled by one knee swell. This is a way in which some unscrupulous American organ manufacturers gull the British public; by multiplying the number of forte stops acting the swell shutters, they can make the organ appear much larger than it is. For the same purpose of making a good show of stop handles for very little money, their number is increased to almost double by adding stops which open the mutes only a little distance instead of the full aperture. This has the effect of greatly decreasing the volume of air passing through the reeds, causing a corresponding decrease in tone. Thus, in the Diapason set of reeds an extra stop is added, called Diapason Dolce, which acts in this way, but is not of much real use in playing. These deceptive stops have all sorts of names given to them, the most common being the Dolce. Each set of reeds being treated in this way, you will easily see how many stops may be added with a very little extra expenditure.

But to return to our work. The next job is to set about fixing the key-frame on the bearers. If we have bought the keys of Mr. Marsh, there will be nothing more to do beyond clothing and screwing down, as the measurements of the frame will be the same as the bearers, etc. The clothing consists of strips of red felt or baize, glued on the front and back rails of key-frame to render the action of the keys noiseless. But for the benefit of those who have keys by them, or intend to get them elsewhere, the measurement of the frame should be  $34\frac{3}{4}$  in. long,  $9\frac{1}{2}$  in. wide, and  $\frac{3}{4}$  inch thick. The keys must be 10 inches long, and, at the same time, I would warn you not to fall into the same error when buying second-hand keys as I did. In order, as I thought, to save, I bargained with a dealer to let me have an old set of Broadwood keys for 10s., and had them re-covered with celluloid. But, when I came to fit the frame on the bearers, I soon made the discovery that the width of the keys, being, I suppose, an old pattern, did not coincide with the width of the reeds, that is, the plungers did not touch each key. There was nothing for it but to discard them and buy a new set. Let this be a warning against an error which I shall not



be likely to fall into again. *Experientia docet.* But before we can fix the key-frame we must not forget to make sixty-one holes in the swell cover, to allow the plungers to pass through and to act as a guide to keep them in position. This is rather a difficult job to get right. Each plunger must be made perfectly upright, and to accomplish this it will be necessary that the holes in swell cover should be identical with the holes in reed-board below. By placing a strip of paper, 2 feet 9 inches long, over the lower holes, and taking the impression, we can transfer their position to the swell cover. As each hole must be bushed with cloth, it will be necessary to make them a little larger than required. Another plan, and one which I have adopted myself, is to make a separate slip of hard wood, about 32 in. long, and bore holes in it to correspond with the holes below—cut a long slit out of the middle of swell cover to fit it into; then the plungers will be perfectly upright, because we can shift it about until the right position is obtained, when it can be glued firmly in its place (τ, Fig. 20). I believe this guide slip can be bought of Mr. Marsh for 4½d.

A key slip must now be made, to keep the keys down in position on their back pins. A piece of wood must be cut the length of the keys, in the shape shown at ν, Fig. 27 a, to fit a slot made in the back of every key. Screw to back of key-frame with half-a-dozen screws.

Place the key-frame on the bearers, in the position shown in Fig. 25, *i.e.*, with front edge of key-frame even with the front edge of bearers and soundboard, also taking care that the top and bottom plungers touch their respective keys about ½ inch from the end of the line of black keys. The other plungers should, also, fall exactly in the centre line of its own key. Now screw down at either end with two stout screws (Fig. 25).

The plungers, if cut somewhere about the right length, should now push the keys up ¼ of an inch. Glue a circular disc of felt on the underside of each key in the place where the plunger touches it. A punch, such as is used for making gun wads, is the sort of thing for cutting out the discs. The insertion of the felt

will have the effect of raising the keys considerably; we must, therefore, reduce the touch to ⅔ths of an inch. The best way to get all the keys of a regular height is, to first get the two end ones and one in the middle alike, by means of a wooden gauge, to the depth of ⅔ths of an inch; that is, allowing a distance of ⅔ths of an inch between the underside of key and its frame; afterwards reducing each key *gradually* by rubbing the end of plunger evenly on a piece of sand-paper. Remember that a very slight bit taken off the plunger affects the touch of key considerably; it will, therefore, be necessary to work at it deliberately and cut away sparingly, unless we wish to spoil a few plungers by cutting off too much. The keys, however, will not be made perfectly level without the aid of a straightedge laid on the top surface, marking and reducing every key which appears above the level. A sand-paper file is a useful tool for the work—it needs no description, simply consisting of a strip of sand-paper glued on to a small wooden block tapering at the ends. As a little time and patience will be needed to get the keys satisfactorily regular, and perfectly even in touch throughout, I will leave you, for this month, to turn our attention in the next chapter to the making of the blow pedals and stop board.

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## HANDY METHOD OF SEA-FISHING FROM ROCKS OR THE SHORE OR PIER.

By W. B.



THE following handy contrivance is a useful aid to sea-fishing, and may be constructed by any of your readers at the cost of a few pence, and in a very short time. Take two pieces of wood, one 12 or 14 inches long by 8 to 10 inches wide, and ¾ inch thick; the other, 8 to 10 inches by 2 to 3 inches, and 1 inch thick; screw them together as shown in Figs. 1 and 2. Bore two holes with ½ inch bit, as in Fig. 1, through the upper piece only; but for convenience in tying up, the holes might be continued with a small bit or gimlet through the lower piece as well. Then get two pieces of tough wood, 2 feet to 2 feet 6 inches long, and



FIG. 3.—  
POST  
WITH  
BELL,  
FIXED  
NEAR  
TOP.

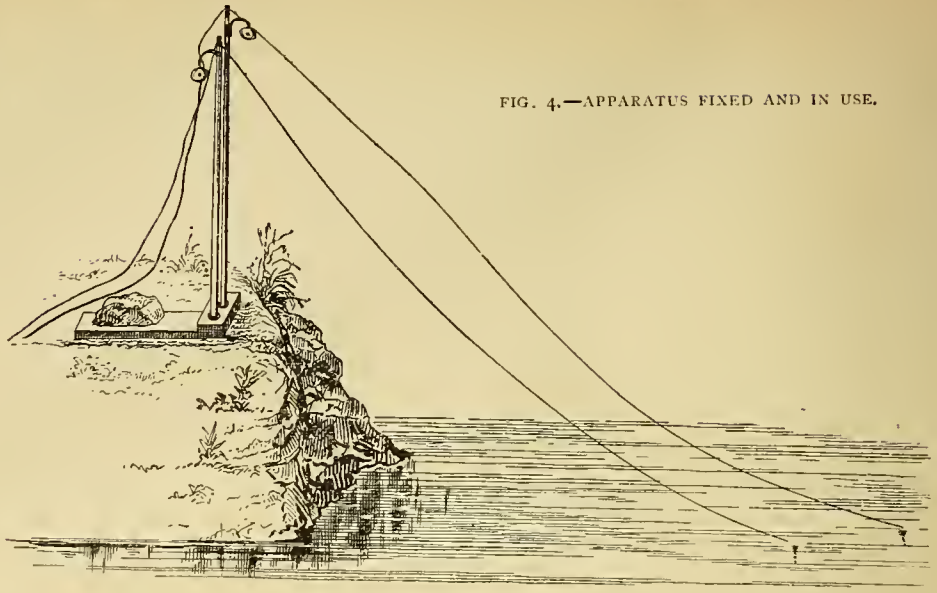


FIG. 4.—APPARATUS FIXED AND IN USE.

$\frac{1}{2}$  inch diameter or so at the bottom, tapering a little to the other end. Make a notch or saw-cut at the thin end of each. Get two little round bells, which cost about 1d. each, at the ironmonger's, and two pieces of copper wire 3 inches or so long. Fasten a bell to one end of each piece of wire, which is easily done by passing the wire through the little ring on the bell for  $\frac{1}{2}$  inch and twisting it round the main piece. Then, with strong waxed thread, bind the other end of the wire to the stick, 2 to 3 inches from the top, as shown in Fig. 3. The apparatus is now complete; in Fig. 4 I have endeavoured to show how it is used.

It is placed close to the edge of the rock or pier, or on the shore at the water's edge. A heavy stone is placed on the board, the sticks are inserted in the holes, the lines are baited and thrown out as far as desired, then brought through the notches, with a turn or two round the stick, if necessary. The angler is then free to read, collect specimens, look after bait, or indulge in any other seaside recreation. The slightest tug from a fish will ring the bell, and recall him to business. I would not advise him to imitate the flunkey, who, after the door-bell had rung loudly several times, said, "he

FIG. 1.—PLAN OF BASEBOARD.

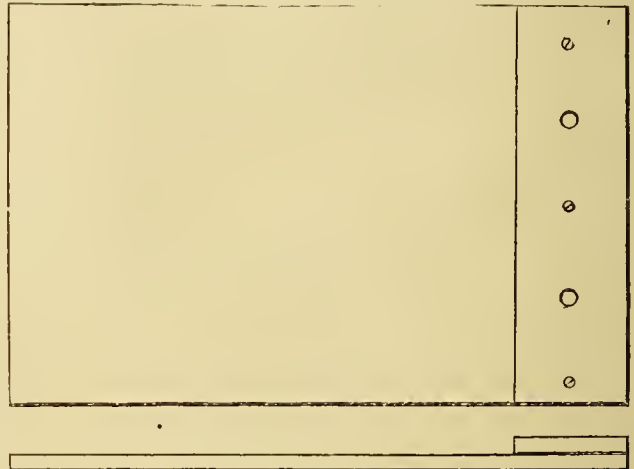


FIG. 2.—SECTION OF BASEBOARD.



thought he heard the bell." This bell should be answered quickly, as the maid-servants do the postman's knock, though in sea-fishing it is well to give a little time, especially when the line is on the bottom. The bell is not affected by the waves even in a stiff breeze, and there is never any mistake about the ring when a fish is on. Those who have sat all day holding a line will appreciate this plan when they try it, and as they may have several of them with lines out in different places, the chances of a good basket are much increased.

## A NEWSPAPER RACK.

By *ELECTRON*.

THE newspaper rack about to be described, although occupying the space of an ordinary sized rack only, will hold nearly twice the quantity that can be put

a  $\frac{3}{8}$  inch centre-bit about half through the rail ; centre the ends of cross rails, and having marked the length to be left square, fix in the lathe, and turn down the ends till a tight fit for the holes ; cut the ends  $\frac{1}{16}$ th inch shorter than the depth of the hole, and take a shaving off one side of the circular tenon or dowel ; then

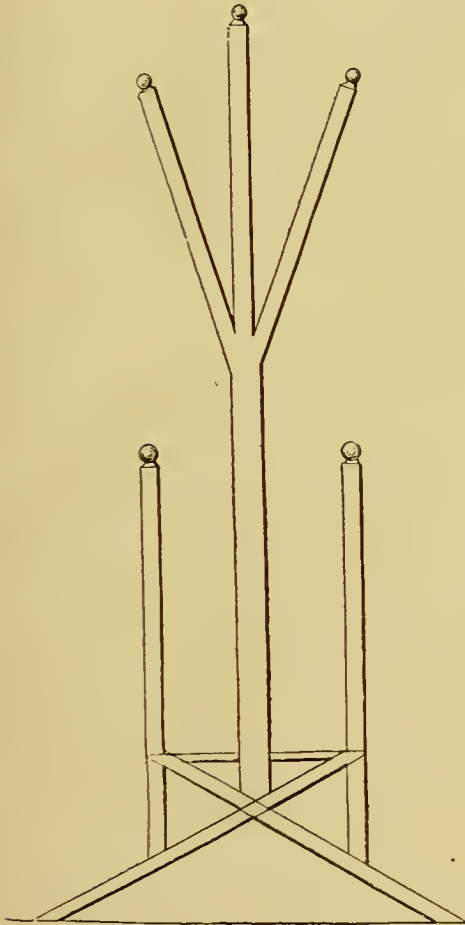


FIG. 2.—END ELEVATION OF NEWSPAPER RACK.

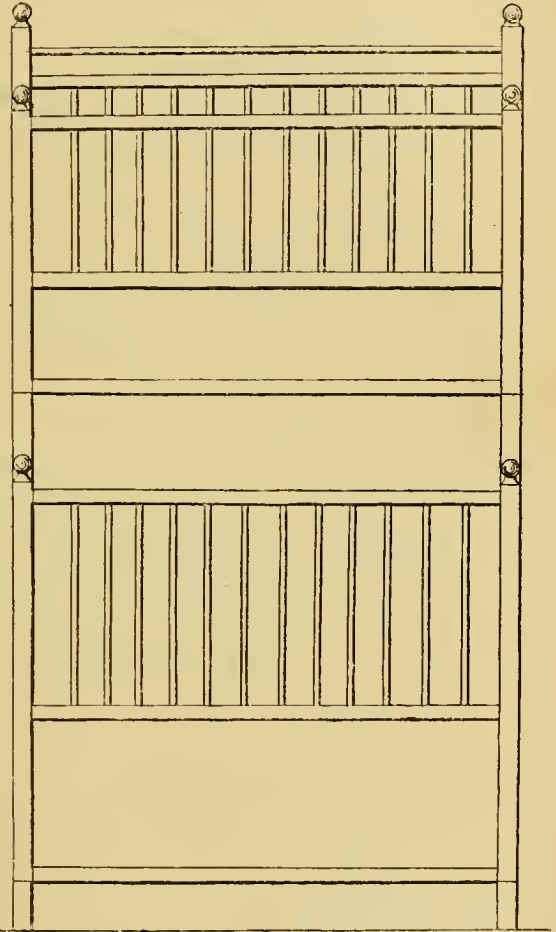


FIG. 1.—SIDE ELEVATION OF NEWSPAPER RACK.

in an ordinary sized rack. It is intended to be made of pine, and painted with the enamel paint now so much used. The rails and uprights of the framing are  $\frac{3}{4}$  inch square ; the joints may be mortised or dowelled. I have lately made some framework of a similar class in the following manner, and which is very strong : Mark the centres of the mortises, and bore with

hammer the end of dowel, to take off the sharp arris, coat the inside of mortise with glue, and drive or cramp the cross rail in, and you will have a good firm joint. A piece of a wire nail may be put through as a pin if considered necessary, and punched down.

The width of rack is 13 inches, and the full height about 2 feet 3 inches. The rail at the



top is brass,  $\frac{3}{8}$  inch diameter, by which it is lifted about; the centre uprights are a little wider than the other rails. The lower part of the framing is filled with a panel of thin pine, about  $\frac{1}{4}$  inch thick; the rails are grooved, the edges of the panel are thinned, and are fixed in the grooves of rails before they are glued up at the joints; the rails on the top of panels are  $\frac{3}{8}$  inch diameter, and may be made in the following manner: Take a piece of  $\frac{3}{8}$  inch pine, shoot one edge straight, and, with a  $\frac{3}{8}$  inch bead-plane, run a bead on the edge; then turn the board over, and run a bead on the opposite side, when you will have a round rod hanging by a thin piece of wood; cut it off with a fine saw, take off the rough edge, and clean up with a piece of glass-paper; you will thus get the rods all one size. The board should be of sufficient length to make two or three rods. Mark off the centres in the cross rails, and bore with a centre-bit  $\frac{1}{4}$  inch deep; cut the rods to length, glue the holes, and fix the rods, taking care to keep the rails parallel; then fix the panels in the grooves, glue the holes, and cramp up each set of frames; the knobs on the top ends of rails may be made turned on the ends of rails, or may be made separate with a pin, and glued into holes in the ends of rails.

The centre upright rails are reduced in size at the top rack, and have a panel and rails fixed in them; a shoulder is left where they are reduced, and upon this the two outer frames rest, with their ends bevelled; the two outer frames can be glued and fixed with screws. After each set of framing is glued up, the joints should be gone over with a sharp plane set fine, to remove any little inequalities.

The feet are half-lapped together, and fixed as shown.

The bottom of lower rack must be notched at the angles and in the centre, to fit inside the rails, and bradded down to slips fixed underneath.

All nails or pins used should be well punched down, and the holes stopped with putty; then smooth all over with glass-paper, and give two or three coats of enamel paint of approved colour.

## HOW TO TURN METAL.

By REV. J. L. DWYER, B.A.

SPEED—ANGLE OF CUTTING TOOLS—POSITION OF TOOLS WITH REFERENCE TO WORK—TYPES OF CUTTING TOOLS.



AS Mr. J. C. Wolfe, in Part 13 of AMATEUR WORK (New Series), is good enough to say that he found my instructions in lathe-making easy to follow, I may be permitted to write a short paper on metal turning, especially as he complains that I supposed a novice to be able to turn steel. Of course, I did that, because instruction in turning was not my object in that article, and I had to pre-suppose a certain amount of knowledge in my readers.

Although many complain of the difficulty of metal turning, yet it is very simple. A few great principles must be thoroughly grasped in the mind, and all details arranged in accordance with them.

I will, therefore, divide my subject into three heads, viz. :—1st. Speed. 2nd. Angle of Cutting Tools. 3rd. Position of Tools with Reference to Work; and these three will be followed by a few types of tools suitable for actual metal work.

*Speed.*—It is found that, if metal is driven too fast, it acts as a grindstone to the tool and soon destroys the cutting edge. This is a truth either not understood, or forgotten very often, by amateurs. They put a bar of iron between the centres of a lathe, drive it as fast as they can, hold a tool against it, and are astonished if the tool comes away a great deal the worse for wear after having done very little good to the bar.

I remember very well when, in turning iron, I used to spend a great deal more time at the grindstone than at the lathe, but things are changed since I learned how to turn.

The following are found to be the best speeds at which the metal should pass the point of the tool. It will be seen that it varies for different metals, and I may remark that it often varies much for different samples of the same metal.

The slowest is cast steel, which should pass the tool at the rate of 12 feet per minute, while

brass may pass it at the rate of 50 feet per minute.

Table of Speeds.

|                     |     |                     |
|---------------------|-----|---------------------|
| <i>Cast Steel</i>   | ... | 12 feet per minute. |
| <i>Cast Iron</i>    | ... | 18 " " "            |
| <i>Wrought Iron</i> | ... | 20 " " "            |
| <i>Brass</i>        | ... | 50 " " "            |

Gun-metal would be slower than brass, in fact, the speed for brass varies much with its hardness.

Now let us take an example, say we are turning a bar of wrought iron 1 inch thick. It will be found by measuring it with a tape, or from calculation, that it is a little more than 3 inches round, *i.e.*, in circumference. Therefore, in one revolution 3 inches passes point of tool; four revolutions, 12 inches or 1 foot passes point of tool; 80 revolutions, 240 inches or 20 feet passes point of tool. From this we may conclude that the lathe mandrel should make eighty revolutions per minute, for that would make 20 feet of the surface of the work pass the point of the tool in that time. The same thing may be shown another way. If we take a thread and wind it round the work, and drive the mandrel at the rate of eighty revolutions per minute, it will be found that 20 feet of thread is wound on per minute; or, conversely, if the tool is made to cut off a continuous thread of metal at that speed, the thread will be found to go off at the rate of 20 feet per minute.

I hope I make this matter plain as it is important. How, then, are we to drive the mandrel at the rate of eighty revolutions per minute? I find that I cannot drive my flywheel much slower than sixty revolutions per minute, and that I can easily drive it at one hundred and twenty. Eighty, then, would be a nice speed, and if the mandrel were driven at the same speed it would do. In other words, the driving pulley should be equal to the driven one, or else the back gear should be used. How many amateurs, in turning a bar of iron 1 inch in diameter, would have it move so slowly? I confess that I often drive it much faster for hand-tools, but they have not to cut so continuously as slide-rest tools. We may take it, then, as a general rule for wrought iron 1 inch thick, that

the mandrel should revolve only as fast as the driving crank. For iron 2 inches in diameter, it would revolve half as fast; for 3 inches in diameter, one-third as fast; and so on, in what mathematicians call inverse ratio. For iron  $\frac{1}{2}$  an inch in diameter, mandrel may go twice as fast as crank; and for iron a  $\frac{1}{4}$  inch in diameter, four times as fast.

For cast iron the speed ought to be slightly slower, but that may be regulated by the pedal. For steel it should be only two-thirds as fast, and for brass it may be nearly three times as fast as for wrought iron.

Few lathes are fitted with pulleys enough to regulate the speed in exact accordance with the rule; a good deal may be done by working the pedal at varying speeds, but many lathes would be much improved with a small pulley on the driving shaft. I had a lathe at one time which I could drive at thirty-six different rates of speed, the shaft rate being constant.

*The Cutting Angle of the Tool.*—I now pass on to the second heading of my subject, and under this head I need say very little. It is scarcely necessary for me to mention that all cutting operations are performed by means of wedges, which are forced between the fibres of any substance by the action of the tools.

For wood the angle of the wedge is small, varying from 30° up, but for metals the angles must be much more obtuse, the smallest being 60°, which is that used for wrought iron, for brass the angle varies from 80° to a right angle.

Table of Cutting Angles.

|                     |     |     |                        |     |     |
|---------------------|-----|-----|------------------------|-----|-----|
| <i>Wrought Iron</i> | ... | 60° | <i>Roughing Brass</i>  | ... | 80° |
| <i>Cast Iron</i>    | ... | 70° | <i>Finishing Brass</i> | ... | 90° |

These angles may be set out with a protractor and template made to sharpen the tools to, or a template may be made like Fig. 1, which I will ask the engraver to produce accurately, and which gives the angles of all cutting tools, and a few others, which are useful for other purposes. The 55°, for instance, is that to which the lathe centres, centre punches, and screw-cutting tools are ground, and the 105° we will see to be useful by-and-by.

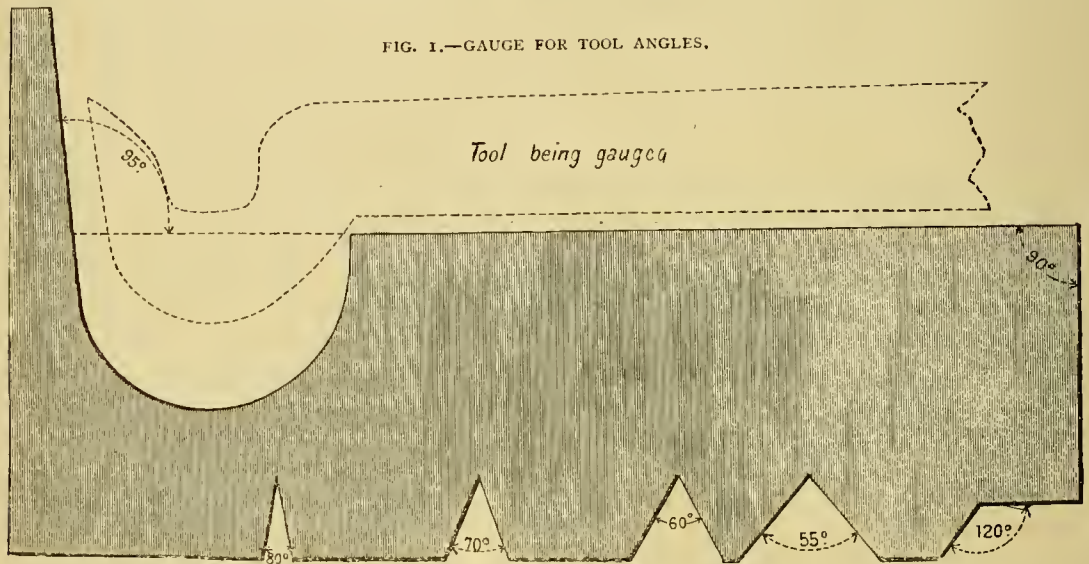
*The Position of the Tool with reference to the Work* is, perhaps, the most important

principle I have to deal with, on it depends most of the success in metal turning. *The point of the tool should be on a level with the lathe centres.* If it is not so, the clearance angle is always varying, and it should be a constant quantity. Fig. 2 will explain what I mean by the clearance angle. The line *ab* is a tangent to the work drawn from the point where the tool touches it, and *ac* is the line representing the front face of the tool, the angle between these two is called the *clearance angle* and should not be less than  $3^{\circ}$  or greater than  $6^{\circ}$ .

It will be seen from Fig. 3 that, although

long before the size shown by the smaller circle was reached. Another disadvantage is that the point of the tool has no support. In Fig. 2 it is seen that the point is supported by all the material under it; but the lower tool, in Fig. 3, would have its point broken off with the slightest pressure. The advantage in having a small clearance angle arises from the same reason. If the clearance is very great, as in Fig. 4, the point of the tool will not be supported, and crumble off. In that Figure the cutting angle of the tool is quite correct, but, because it is badly set, it is useless for work, *i.e.*, for wrought iron; it

FIG. 1.—GAUGE FOR TOOL ANGLES.



the tool may be made to cut when the work is large, even when it is above the centre, yet when the work is turned down somewhat, the point will not bear at all upon it. Of course, the dotted line in Fig. 3, will scarcely ever represent truly the position of a tool in real work, yet some of the intermediate positions would do so. If the workman pressed the tool hard against a thin bar when it is so set, the consequence would probably be that it would spring up, catch the point of the tool, and jump out of the lathe, perhaps knock his eye out. If the tool, on the other hand, is placed too low, it will cut for some time with a sort of scraping action, but Fig. 3 shows that it would cease to do even that,

might scrape brass well, but would require constant sharpening until the edge got thick enough for support. Now let me sum up. Hold the tool, having a clearance angle of from  $3^{\circ}$  to  $6^{\circ}$ ; have the cutting angle that suitable for the material being turned, and drive the lathe at the proper speed, which is much slower than is generally supposed.

But we must remember that the clearance angle is required in every direction that a tool cuts, and if, for instance, we are cutting from right to left, the left-hand edge of the tool should have a due amount of clearance. I have endeavoured to show this in Fig. 5, which shows a section of the end of a bar and a tool, whose



point may be all right, but whose left-hand edge has no clearance whatever, in fact, if it was traversed against the bar its lower part would entirely prevent the edge, *c*, from getting into operation. Clearance should be given, as in the dotted line. Fig. 6 shows the end of a tool made to traverse from right to left. This is a screw-cutting tool, which requires to rake very much

material to be turned is wrought iron, cast iron, or brass. There are little nicks like saw teeth filed in the under edge to catch on the top of the hand-rest and keep the tool from slipping.

The tools vary in length, some of them are long enough to put the end of the handle on my shoulder, and for heavy work it is necessary, but most of that kind of work is done with the

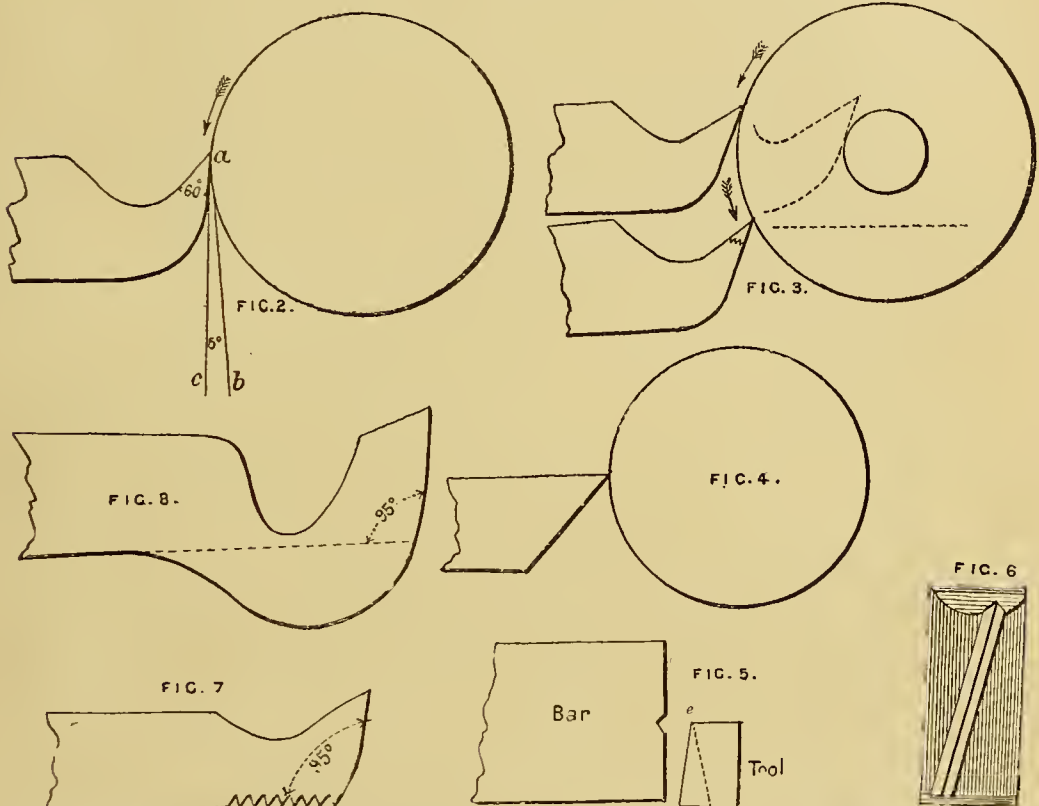


FIG. 2.—EXPLANATION OF THE TERM "CLEARANCE ANGLE." FIG. 3.—POSITION OF TOOL IN RELATION TO CENTRE. FIG. 4.—EXCESSIVE CLEARANCE. FIG. 5.—SECTION OF END OF A BAR AND TOOL SHOWING TOOL WITHOUT CLEARANCE. FIG. 6.—END OF TOOL MADE TO TRAVERSE FROM RIGHT TO LEFT. FIG. 7.—SIMPLE METHOD OF MAKING TOOL. FIG. 8.—SLIDE-REST TOOL WITH LARGE ALLOWANCE FOR WEAR OF EDGE.

to suit the slope of the screw, but every tool should rake more or less.

Now as to tools, I find I can make them very well of best tool steel,  $\frac{5}{8}$  inch by  $\frac{1}{4}$  inch, filing down a circular depression on top, to make the proper cutting angle, as in Fig. 7. The angle between base and front is  $95^\circ$ , which can be regulated by Fig. 1, and the cutting angle,  $60^\circ$ ,  $70^\circ$ ,  $80^\circ$ , or  $90^\circ$ , according as the

slide-rest. Many slide-rest tools are made like Fig. 8, so that there is a large field for wear of the edge. The hollow near  $95^\circ$  in Fig. 1 is for convenience in gauging these tools. Of course, they must be packed up as they wear, so that the point will be always on a level with the lathe centres.

I think I have said as much as I ought to about this subject, but it is far from exhausted.

Let the workman look out for the angles. If he has a slide-rest let him clamp the tool, and bring it up to the work, but, before he cuts, let him put on his considering cap and study well what part of the tool will be brought into operation, and then let him make sure that that part has the requisite clearance and the correct cutting angle. He will find that the cutting angle varies all round the tool. At the point it may be  $60^\circ$ , but at the sides it will slope off to  $90^\circ$ —let the  $60^\circ$  be directed towards the middle of the shaving. A slide-rest tool should generally be pointed more or less in the direction in which a cut is being taken. If what I have said is attended to, I am sure anyone with brains can learn quickly to turn well. Metal turning is really easier than wood turning, although I agree with Mr. Wolfe that wood should be practised on first.

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## HINTS ON CHINA PAINTING.

By *ROUGE DRAGON*.

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 HERE are many methods of decorating pottery or china; the difference between it and ordinary painting is that, in pottery painting, the work is subjected to the intense heat of a furnace, which blends together the colour and the ground, making them integral parts of one another. This is especially the case in work done under glaze, as it is called—when a design is painted on the porous clay, and the colour sinks into it and becomes actually part of it—the glaze is then put on over this, and the decoration is absolutely indelible. But the painting under glaze is a most difficult art to acquire, and needs years of practice, and is subject to many disappointments, as the slightest variation in the heat of the furnace, or in the amount of colour put on, may completely spoil the work, or produce most unexpected results.

But to paint upon white or buff-tinted tiles, plates, etc., that have already been glazed, is quite a different matter, and can very easily be acquired, after a few experiments and failures, which are inevitable, before we can learn the

effect that the firing will have upon the colours used. And here I should like to give a word of advice to beginners—do not, at the outset, buy an expensive box of “colours for china painting,” containing a great variety of paints, which it will take years to learn the management of.

Of course, it is a great advantage to a beginner to have a few lessons from a practical china-painter, but to many who live in the country this advantage is quite out of reach, and it is to these that I hope the few hints that I can give will be of some use and encouragement; for it is quite possible to accomplish simple, but artistic work on china, without special instruction, though I think it is essential to have *some* knowledge beforehand of drawing and how to handle a paint-brush. A neat and steady hand is indispensable also.

I should advise the purchase, to begin with, of two colours—“Rouge chair,” and “old tile blue”—they should be Hancock’s powder colours, and can be had from Howell and James’, or Lechertier and Barbe’s; a fine outlining brush, and an ordinary medium-sized sable one, a bottle of “fat oil of turpentine,” a palette knife, and a few white-glazed 6-inch tiles, that can be got from any crockery shop at 4d. or 6d. each; one of these should be kept for mixing colours upon. What is called a “dipper,” for holding the turpentine, should also be procured. And now, to begin decorating one of the tiles. A simple spray of flowers, without too much detail in it, will be the least difficult subject to start upon. The illustrations to “Familiar Wild Flowers,” by Hulme, which came out in numbers a few years ago, are just the right style for china painting; there is a most graceful wild daffodil in it, just a single flower, a bud, and a few straight leaves, which I would suggest for painting on the first tile. And now, as to getting the outline of the design on to the tile. On the slippery glazed surface it is almost impossible to make any mark with the pencil, there is a kind of black chalk, which does make a mark on china, but it is very troublesome to get this to a fine point. Far the most satisfactory method is, if possible, to draw the design straight on to the tile with the colour. But if the artist cannot

trust himself to do this, it may be transferred by first tracing it with transparent tracing-paper, and then using black paper to transfer it on to the tile. This done, the colour should be prepared by taking a small quantity of the "old tile blue" powder on the palette, and a *very* small quantity of the fat oil on the tip of the palette knife. Mix the powdered colour up with this, and rub and grind it down for some time. A little turpentine should also be taken with the knife from time to time, when the colour gets too stiff to mix. The "old tile blue" requires a great deal of grinding, as it is more gritty than most colours; but it is very important that the powder should be thoroughly ground and mixed into quite a smooth paste, before beginning to paint.

When it seems to be really smooth, and thoroughly mixed with the fat oil and turpentine, the outlining brush may be gently dipped into it, without taking up too much paint at a time, and the outline of the pattern carefully gone over with the point of the brush. This is work which requires a good deal of patience, as the colour clogs very quickly in the brush and refuses to work; the only thing to be done, then, is to wash it out in the turpentine, and take a new brushful of paint. After some time, very often before a design is finished, all the colour on the palette becomes so dry that it cannot be used any longer. It must then be mixed up again with the palette knife, and a little more turpentine—not too much, or in the next stroke the colour will all run and look coarse and blurred. It is only with practice that one learns exactly how thick, or how thin, the paint ought to be, in order to work really satisfactorily.

When a firm, even outline has been drawn with the brush, to the whole design, it is better to leave it until the next day before doing anything more to it, by which time the colour will have become thoroughly dry. The work should always be put away in a drawer or cupboard, on leaving off working, to protect it from dust as far as possible, though little particles of dust and tiny hairs are sure to get into the paint sometimes, and make it dry unevenly; these must be removed very carefully, while the paint

is wet, with the point of a needle. On this account it is better to paint in a room where there is no carpet, or curtains, to produce dust, and the table should never have a woollen tablecloth on it. Next day, if the outline is not quite dry, it should be put into a kitchen oven for a time, and then left to cool, when the work may be proceeded with.

The other brush (the sable) will now be used. Mix some fresh colour in the manner described, and take a little in the brush, mixing a little more turpentine than before, as it will be required to work more freely. Then put in washes, as evenly as possible, where the shaded parts come in the design, and soften it off to white, in the lightest parts. Never touch into a wash again until it is dry, or the brush will fetch away all the under colour, and it will be most difficult to patch it in again.

The different gradations of shade in a flower and its leaves will require several washes, darkened each time, until something of the same effect of light and shade as in the copy, has been obtained. The tile can always be dried in the oven after each wash, to hasten its completion, as these tiles can stand great heat.

Tiles painted thus, in one colour, are the simplest style of work to attempt in beginning, but they are very effective, and can be made useful in many ways. I have painted a set of them myself, in old tile blue, to decorate the sides and top of a mantelpiece, set in dark wood; and they may also be painted so as closely to resemble old Dutch tiles (which were always of this shade of blue) and the whole inside of a fireplace lined with them. I have also had them mounted in an oak frame, and raised on little balls at the corners, when they make very pretty stands for a teapot and milk jug at breakfast. I give a design, Fig. 1, which I painted, from the natural flower, on one of my tiles, to give an idea of the size and style of work that I have tried to describe. It is much better for beginners to gain a little experience, and facility in using the rather troublesome powdered colour, by work like this, than to attempt using all the colours in a landscape on china, or some other equally complicated subject (as I have seen done more



than once) without the slightest knowledge of the effect of the colours on one another, the difference that firing makes to each, the exact quantity of medium to use, etc., with the inevit-

the colours fired out altogether, some blistered (on account of too much fat oil having been used), and all looking cold and thin. But if each colour is taken separately, and its peculiarities



FIG. 1.—SIX INCH TILE IN BLUE.

able result of disappointment, often leading to the abandonment of the work altogether. The piece of work, which gave such satisfaction when sent off to the kiln, comes back with some of

studied well, there need be none of this disheartening failure.

I would advise, next, a trial of the "rouge chair," which is a colour that is much less

gritty than the blue, and so is more easily mixed, and pleasanter to use, and with this a further step may be attempted in the art of china painting, *i.e.*, to lay in a background.

A design of flowers should first be outlined, as in the first tile; one that covers the tile well all over, without leaving very large spaces of background, will be the easiest for a beginning. When the outline is perfectly dry and hard, take the larger brush, and when the powder and medium are thoroughly well mixed and *quite* smooth, take a good quantity in the brush, but do not fill it *too* full of colour. Then fill in the background with broad, steady strokes, being most careful to keep within the outline—if there

A set of teacups and saucers, decorated with simple sprays of flowers, in this red, have a very pretty effect. Large daisies, cherry blossom, or strawberry flowers, may be outlined from nature upon the cup, and then delicately shaded and veined. The rest of the cup should be left white.

Many beautiful conventional designs may be copied from old china cups, etc. I give here a border, Fig. 2, taken from a little old Oriental bowl; the original was painted entirely in red, and it is not at all difficult to copy on a cup—only great delicacy is required, and a very fine-pointed brush for the outlining part, and this should be allowed to get thoroughly dry, before attempting to shade and finish the work.



FIG. 2.—PATTERN FROM SMALL ORIENTAL BOWL TO BE PAINTED ENTIRELY IN RED.

is too much turpentine with the colour, it will run over the edges on to the design; but on the other hand, if there is too *little*, the colour will dry too quickly, and not smoothly. In any places where it has run over the design the paint may be scraped off with a penknife, when it is nearly dry.

"Rouge chair" is such a pleasant material to use, and obeys the brush so much better than many of the other colours, that a background can generally be laid smoothly with only the medium-sized brush, but some other colours are more difficult to manage, and a background must then first be laid with broad strokes of the brush, and then dabbed over before it is dry with a flat brush, called a "*putois*."

Any paint that is left over on the palette, when the work is finished for the day, should be cleaned off, and the palette rubbed dry. This seems rather wasteful, but old colour that has dried is never satisfactory to use again, it should always be mixed freshly each time before using, and it is best not to mix a large quantity at a time, except when a ground is to be laid in. After working for some time in one colour, and having seen the effect of firing upon our work, it will be time to try our hand upon a combination of colours in one plaque or tile—again, I would advise a flower, but painted this time in its natural tints. Yellows are very pleasant to use, and they fire well—but pinks are very difficult to manage, and a good scarlet almost



impossible to get in these colours. The best yellows are, "jaune jonquille," "jaune à mêler," and "orange."

All work on china is, to my mind, much improved by being outlined, and for these colours the outline to the whole should be brown. Hancock's Vandyke brown does very well for this. Yellow flowers should be shaded very delicately with a grey, composed of "vert bleu riche," brown, and carmine; very little of this should be taken in the brush, and it should be lightly laid on in the shaded parts.

Greens require a great deal of care in mixing. Powdered greens of different shades may be used, but they are too crude by themselves, and must be toned down with orange and Vandyke brown. A very nice olive-green can be made with "vert bleu riche," orange, and brown, well mixed together, and a little more of the blue used in shading. For a delicate pale green use "jaune à mêler," with one of the made-up greens.

A very nice cream coloured background can be produced by using orange very thin, laid on with broad, swift strokes of the brush, and, if possible, without putoising; this colour is easier to lay on smoothly than many others.

A painting will often require re-touching after it has been fired, the colour may have become too pale in some places, or have blistered, so it is often necessary to paint it over again, and patch up the "bubbles" as far as possible, when it can be sent to the kiln again. After a great many experiments and failures in trying different china-firers, I now always send my work to Messrs. Lechertier and Barbe, in *Regent Street*, all that I have sent to them has returned beautifully fired, and I have never had anything spoilt there. I always feel confident in sending to them that I shall be pleased with the result of my work and its finishing process.

I also strongly advise the use of Hancock's powder colours. There are some few tints that can only be got in the French colours, but these should be bought in powder, not in tubes, and both kinds are to be had from Messrs. Lechertier. I shall hope, at a future time, to give some other designs for tiles, and for painting on plaques.

## AN ENAMELLED BRACKET.

By THE MOCK TURTLE.

(For Illustrations, see Folding Sheet presented with this Part.)



If you want to make a pretty bit of furniture that shall only cost you a mere trifle in cash and not very much in time and trouble, I can strongly recommend the bracket which I am now going to describe to you to the best of my ability.

It is made of thin pine, and is, therefore, easy to work, and consisting, as it does, partly of fretwork and partly of joiners' work, it is likely to be of interest to woodworkers generally. Moreover, the joiners' work will not greatly try the skill of the maker, since the only part of the structure in which joints, properly so called, are used, is the door of the little cupboard in the centre, which should be framed up, if you desire to have a workmanlike finish about your bracket when complete.

I may say that the design is not entirely original, the main idea being taken from a painted bracket that I saw in a shop in Oxford Street. Being struck with the satisfactory effect of the article as it appeared in the window, I took it away with me without going through the formality of asking the owner's permission. Don't be alarmed! I mean that I took it away in my pocket-book in the form of a sketch, and a few days subsequently, after getting out a working drawing, I made a bracket somewhat similar to the one I appropriated, but altered, and, as I think, improved in several details.

The cost of materials for the job is very little, not more than a couple of shillings at the outside, and is quite incommensurate with the handsome appearance of the finished work.

Select a piece of dry wood, free from knots, of a thickness to finish  $\frac{1}{4}$  inch when planed down; have a keen edge on your plane iron, so as to produce a nice smooth surface on your work. It is well not to delude yourself with the idea that because the wood is to be painted a little slovenly planing will not matter, because you will find that irregularities of surface will show through the paint, no matter how many coats you apply.



First, cut out a piece for the back, as shown in Fig. 2, quarter size. The corners at *a* and *b* may be cut with the fretsaw by taking a tracing of Fig. 3, which is full size, and transferring it to the wood.

Next, cut two pieces for the sides, as Fig. 4; the piece for the left hand side to be the full size indicated by the drawing, and the piece for the right-hand side to be less by the thickness of the wood, as shown by the dotted line. The corner, at *b*, to be cut as explained for cutting the back. At the top of the narrower of these two pieces—*i.e.*, the right-hand side piece—cut the fretworked pattern given in Fig. 5.

Now put the sides in position on the back piece, Fig. 2; the fretworked piece on the dotted lines, *c*, *d*, and the other piece *against* the left-hand edge. Fasten them in their places by means of thin screws, the heads of which should be well countersunk and puttied over. Cut a piece for the top and screw it on. You will, of course, get the size of this from actual measurement, and let me caution you to see that all corners are absolutely square.

Now put in the shelves that form the top and bottom of the cupboard, to which the last remarks also apply. The distance from the underside of the top of the bracket to the top of the first shelf is the same as the length of the fretworked piece, Fig. 6, and the length of the cupboard is  $8\frac{1}{2}$  inches.

The sloping shelf under the cupboard is shown, full size, in section at Fig. 10, which also shows the angle at which it is to be fixed. The top of this shelf is  $4\frac{1}{4}$  inches from the bottom of the cupboard, and it will be noticed that it has a moulding worked on the front edge. This and the other shelves are fixed by means of screws put through the sides, the heads of the screws being countersunk and covered with putty.

Next, cut out and fix the corner shelves, shown, full size, in Fig. 7. The top shelf is on a level with the top of the cupboard, and the other 2 inches below the bottom. These shelves should be glued on to thin ledgers, and due care

must be exercised to have them perfectly level. The fretwork piece shown in Fig. 6 may now be cut and fixed in position by means of slips of wood glued behind it in the angles formed with the sides and top.

Round the top of the bracket fix with screws the pieces shown in Figs. 8 and 9.

Frame up and fit the cupboard door, the centre of which is one of the Japanese panels, that can be bought for a few pence ready for use, and very beautifully worked they are. The thickness of the framing is  $\frac{5}{16}$  inch, and as this is too thin for a groove to take the panel, I cut a rebate round the inside edge at the back, and dropped the panel into its place after putting a little glue on the edge.

The woodwork is now ready for two coats of Aspinall's Enamel, of the shade known as Hedge Sparrow's Egg Tint. When this is thoroughly dry, hinge on the door with fancy brass hinges, supplied by dealers in fretwork materials, and fix a small brass catch to fasten the door with. The back of the top compartment should be covered with a piece of Japanese gold leather-paper, which will look better if arched from front to back. This is easily accomplished by gluing the Japanese leather-paper on to a piece of thick cardboard, about 2 inches longer than the compartment, and when dry, springing it into place.

A couple of cabinet hangers fixed to the top of the bracket will serve to attach it to the wall where you propose to hang it.

It will be noticed by the reader that *both* sides of the bracket, as shown in Fig. 1, are fretworked at the top division. This gives the article a lighter appearance but is by no means absolutely necessary, and may well be left to the judgment of the maker. In fact, a good deal depends upon the position in which the bracket is to be placed when finished. If near an angle of the wall, so that the wall-paper would be seen through the interstices of the fretwork, then, by all means, omit the fretwork on that side. If, on the other hand, that is the side first seen upon entering the room, the fretwork will be a decided improvement, as it will relieve the first impression of plainness.

## SASH-MAKING.

By FAUST.

II.—SETTING OUT AND WORKING RAILS AND SASH BARS—  
MORTISING—TENONING—CHECKING AND MITREING.

OW for the rails. Lay them down on the bench edge up, putting a piece of wood under the narrowest to bring the edge level with the broad rail. Mark, as before, the extreme width of the sash, which is 2 feet, then lay off towards the centre the width of your stiles, that is,  $2\frac{1}{2}$  inches, square across these marks, measure off from them towards the end of the wood  $\frac{1}{8}$  inch and  $\frac{5}{8}$  inch, square across these marks on the edges. Now square across the "face" of each rail from the  $\frac{1}{8}$  inch marks, and across the back from the  $\frac{5}{8}$  inch marks, make a sharp clean cut, as this is where you cut in the shoulders of the tenons. A reference to Fig. 4 shows the rail with the tenon cut, and will illustrate the way in which the shoulders are to be marked off. After the tenon is cut out, take a  $\frac{1}{2}$  inch chisel and cut down from the back edge of the rail to the bottom of the tenon a rebate, as shown at A in the Figure,  $\frac{1}{8}$  in. deep. Divide the rail into two equal parts, and mark off your mortise for the sash bar as you did on the stiles, but in this case the mortise must go through the rail.

To set out the sash bars: lay one on the rail and another on the stile, and mark off the mortises and tenons. In the case of the shortest bar you will find all your marks on the rail; but for the longer bar, after you mark it off from the stile, you must mark off the  $\frac{5}{8}$  inch and  $\frac{1}{8}$  inch marks, towards the ends. Fig. 5 shows how the ends of the bars are to be tenoned, the longest shoulders being to the face edge.

Now as to the mortises in the centre of the cross bars, where they interseet. This is a most difficult thing to explain in print, and you will have to be guided by the drawing and a little "brain." Fig. 6 shows a full-sized view of the bar and how you must mark it. As we go on the explanation of these marks will become clear. Mark the bars on both sides and across the edges. A little tool called a "sash-scratch" can be bought for a few pence which will make

these marks, and also the marks on the rails, at one draw. It is an extremely useful thing to have, and is well worth its cost.

Set a mortise gauge to a  $\frac{1}{2}$  inch chisel, and set the head of the gauge  $\frac{1}{8}$  inch from the mortise. Mark off your mortises and tenons in rails and stiles, also in the bars, always running the gauge from the face side of the wood; then set a marking gauge so that it will cut the mortise on the bars into two (see Fig. 6). These mortises are to be taken out with a  $\frac{1}{4}$  inch chisel, the one next the *front* edge of the longest bar, and the one next the *back* edge of the short bar.

After mortising and tenoning your stuff you must next proceed to "stick," or run, your mouldings and glass checks, as the rebates for the glass are termed. To fasten the wood on the bench so that it may be kept steady while doing this, adopt the plan shown in Fig. 7. Screw on two strips of  $\frac{3}{4}$  inch wood to the bench top, with a wedge-shaped piece to tighten up with, take one of your stiles, place it in position, face next you and edge up, tighten up the wedge, and you will find it held as firm as if in a vice. Set your sash fillister to run the glass check; it must just clear the back edge of the mortise, and be exactly  $\frac{3}{8}$  inch deep. Having run the check, take your jack plane and run a chamfer off the front edge next you; this is to assist your sash plane a little in working down. You will find the sash planes marked 1 and 2. No. 1 is used to rough down the wood, No. 2 to finish off with. Hold the plane steady, keeping the fence close to the side of the stile, and run the plane clear from end to end of the wood; work it until it will take off no more shavings, then use No. 2 plane, which will take off a shaving or two more, and put on a fine finish.

Having run your stiles (of which Fig. 8 shows a finished section), do your rails in the same manner. When done, lay your framing aside and proceed to the sash bars, which require a different method of treatment, and are rather more difficult to manage than the framing. Fix them on edge on the bench, in the same manner as you did the stiles; keep the *back* edge up, set the sash bar fillister to cut away each side of the wood equally, leaving the tongue in

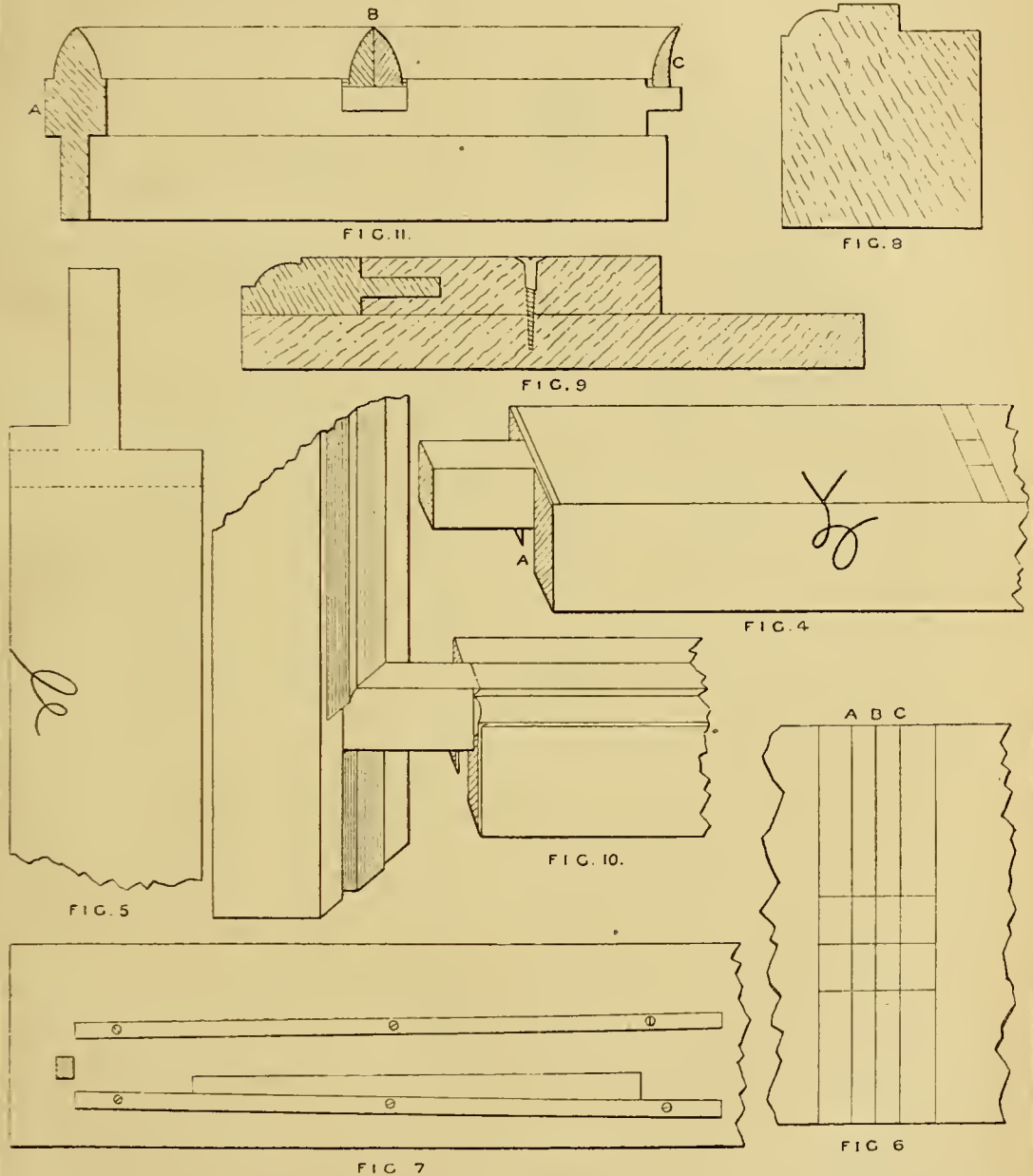


FIG. 4.—PART OF RAIL, SHOWING TENON AND REBATE. FIG. 5.—PART OF SASH BAR, SHOWING HOW TO SHOULDER TENON. FIG. 6.—FULL SIZE OF BAR DRAWN FOR CUTTING AND MORTISING. FIG. 7.—MODE OF SECURING WOOD ON PENCIL. FIG. 8.—SECTION OF FINISHED STILE. FIG. 9.—SECTION OF "STICKING BOARD" WITH SASH BAR IN POSITION. FIG. 10.—MODE OF MITREING FRAMING. FIG. 11.—MODE OF MITREING BARS.

FIGS. 4, 5, 8, 9, 10 AND 11 ARE HALF SIZE.



the centre of the bar; run down to the same depth as the width of the check on the framing, that is, to the back edge of the mortise. Do both sash bars in this way; and then to run the moulding you will require to make what is known as a "sticking-board," a section of which is shown in Fig. 9. It is formed of two pieces of  $\frac{5}{8}$  inch wood, and should be made about the length of your bench. The drawing shows clearly the construction of it, with the sash bar in position; the bottom piece should be about six inches wide, the top piece about three inches. The groove may be run with a plough, and should just allow the bar tongue to fit in firmly. This piece must be fixed to the under piece with screws, to admit of its being shifted to suit various widths of sash bars. When placing it in position, put in the bar and keep the front edge of it flush with the front edge of the lower board, then fasten firmly down. If you have not got a plough to make the necessary groove with, you can build the top board up in three pieces. Run the moulding on one side, then turn the bar, and run the other side. As your plane works down on the second side, hold it very steadily or it will spoil the bar when the two mouldings meet. A section of the finished bar is shown at a, in Fig. 11.

The next part of the work is to mitre and scribe your framing. For this purpose you use the templates supplied with the planes (the application of which to the mouldings will be self-evident). Fig. 10 will show how this ought to be done. Mitre the moulding on the rails, keeping your template to the inside mark on the edge, then cut down the mitre with the flat gouge for about an inch or so on the shoulder; cut only the round of the moulding, leaving the small piece of wood between the round and the tenon still mitred.

Take the stiles, lay on your template to the inside edge of the mortise, mitre the list of the moulding down to the top of the round, that is, about one-sixteenth inch, then about three-quarters inch along the side of the mortise cut the round down to its bottom with a sharp chisel, and clear away completely the whole of the round right to the end of the stile, leaving

the square piece in the middle of the stile at the outer end of the mortise. This piece, when you put your window together, will fit into the rabbet you cut in the rails on the underside of the tenon and aid in keeping your joint firm and steady. When you fit your rail and stile together you will find that you have a perfect joint. The mortises in the centre of the stiles and rails must be simply mitred. Lay on the template to one side of the mortise, cut down to the bottom of the round, reverse the template and cut down the other side, remove the piece from the centre, and your mitre is complete.

Take the cross sash bar, cut it right through the middle of the mortise, that is, at the line marked b in Fig. 6; then cut off the pieces from the tongued edge, as denoted by the lines a, c, mitre the moulding, using the double template, and with a chisel take a little piece out of the centre of the mitre, so that when in its place it may not bind on the bottom of the mitre into which it fits. This end of your bar will now present the appearance shown at c in Fig. 11. Mitre the moulding at the other end in the same way, and cut the tenons to  $\frac{3}{4}$  inch long, taking care that they do not "bottom" in the mortise. The upright bar is *not* to be cut. Mitre it, as shown at b in Fig. 11; try the end of your cut bar into it and you will find out the beauty of the joint which was so intricate and puzzling to you to understand when you began. The tenons of this bar go right through the rails, and are mitred in the same manner as the other.

The mitreing being all done take a fine set hand plane and take off just one shaving along the flat piece on the edges of your framing and bars, between the moulding and the check. This is not absolutely essential, but it gives a clean and finished appearance to your work. Put your long sash bar into the rail mortises, then put on your stiles and put in the crossbar. Lay down two pieces of wood across your bench long enough to rest the sash on, see that they are out of twist, put down the window on them, face upwards, and cramp up with a joiner's cramp. Let your mortises and tenons have a good thick coat of white-lead (it holds better than glue on outside work), dip the wedges

into it before driving them home; before you remove the cramp bore  $\frac{1}{4}$  inch holes right through the stile, about half inch from the edge of each of the tenons, and drive in a pin tightly. Your joints will now hold, and the cramp may be removed.

To ascertain whether your sash is square or not while cramping up your second rail, apply a thin rod diagonally from corner to corner, mark with a pencil where it touches the edge of the rail, reverse it, and if the pencil mark comes to the same point at opposite corners, your sash is square. If it is shorter or longer, shift your cramp a little so as to bring it right; do this before tightening up your wedges. After cramping up the rails, turn the cramp and wedge up the long bar—do this very gently—casting your eye along the bar to see that you do not bend it, which is very easily done in the wedging, and which is very difficult to undo when once done. Cut off the superfluous wood of the tenons, wedges, and pins, lay the sash on the bench, secure it there by strips of wood cut to fit between the stumps of the stiles, plane up the back with a fine hand plane (taking care not to knock off the tongues of the bars), turn it and clean off the face, then cut off the stumps, and your sash is finished.

Fig. 1 shows the sash as put together, the dotted lines showing the tenons and wedges, the black spots, the pins. Of course, in the figure the stumps are not cut off.

The foregoing is one of the simplest forms of window, and will form a good lesson for the beginner to start with, as the mortising, tenoning, checking, moulding, and mitreing of the various sashes to be described in these papers will all have to be done in much the same manner as the one here described; and having once mastered these mysteries, it will be almost plain sailing when we come to deal with hanging and other windows.

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WALNUT STAIN FOR DEAL. — One quart of water, one and a-half ounces common soda, two and a half ounces Vandyke brown, one quarter ounce bichromate of potassium. Boil for ten minutes and apply hot or cold.

## A NEGATIVE WASHING-BOX.

By F. S. M.



ASHING negatives is tedious work for the amateur, and to stand and hold one under the tap for fifteen or twenty minutes takes the interest out of photography somewhat. Relief from this slavery may be had by means of a simple washing-box, which is easily made and automatic in its action.

The one I describe is for a 5 by 8 plate, or smaller, though, of course, the dimensions may be altered to suit. Take pieces of common tin as follows: one piece  $11\frac{1}{4}$  inches by  $8\frac{1}{2}$  inches, one piece  $5\frac{1}{4}$  inches by  $9\frac{1}{2}$  inches, and one piece  $3\frac{1}{2}$  inches by 6 inches. Bend the large piece on the dotted lines shown in Fig. 1, so that it will remain the shape of Fig. 2. The sides should be  $3\frac{1}{2}$  inches, and the front  $5\frac{1}{4}$  inches wide. Now take the second piece and bend one end over at an angle, so that the edge will look like Fig. 3. Solder the second piece inside the first-mentioned one on the lines, as shown by the dotted line a in Fig. 4. Previous to soldering, however, a hole should be cut  $\frac{1}{2}$  inch from the top of the front of the large piece, and a collar of  $\frac{1}{2}$  inch brass tube soldered in. The result will be a box 3 inches by  $5\frac{1}{4}$  inches square at the top, but only  $5\frac{1}{4}$  inches by 1 inch at the bottom.

Now take a piece of rubber tubing about a foot and a half long, just large enough to fit closely into the brass collar, and run it through the same, one end reaching to the bottom inside and the other the same distance outside. Be careful not to have it close to the bottom inside, but leave a space large enough for the water to enter it. Also, be careful that the rubber tubing does not get compressed in any way in making the turns. A couple of wire staples soldered on the inside will keep it from touching the plate.

Now cut the third piece of tin, as shown in Fig. 5, and bend up the edges on three sides, and solder. A couple of lips should be bent out at A, A, to hold it from dropping into the box. Punch a row of holes in the deepest side of the three-sided box, and everything is complete.

To use the apparatus, place the negative, face up, on the slanting shelf, put the perforated cover on, and set under the tap. Turn the water on, using only a small stream, just enough to sprinkle the plate. If the holes are punched rightly, which will be found by trying two or three sizes, a thin sheet of water will pour down over the plate, and the box will gradually fill up, soaking the plate at the same time. When full, the water will commence to run out through the rubber tube, which, as a siphon, continues to

act until the box is empty; then the process is repeated. To wash a small plate, wedge a piece of wood inside for a stop, letting the plate go only part way down.

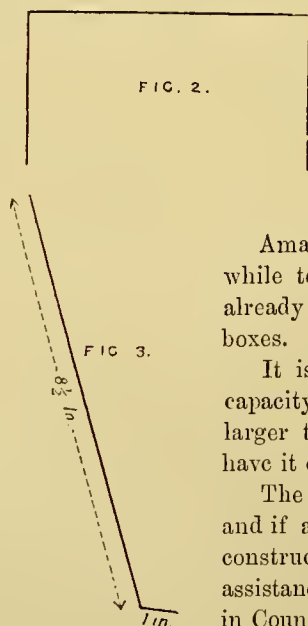
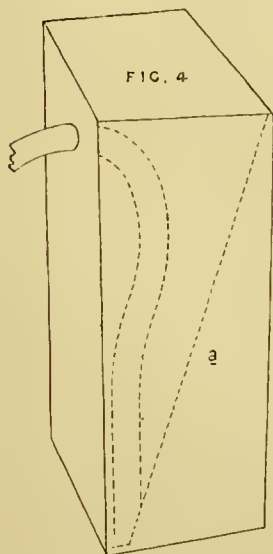
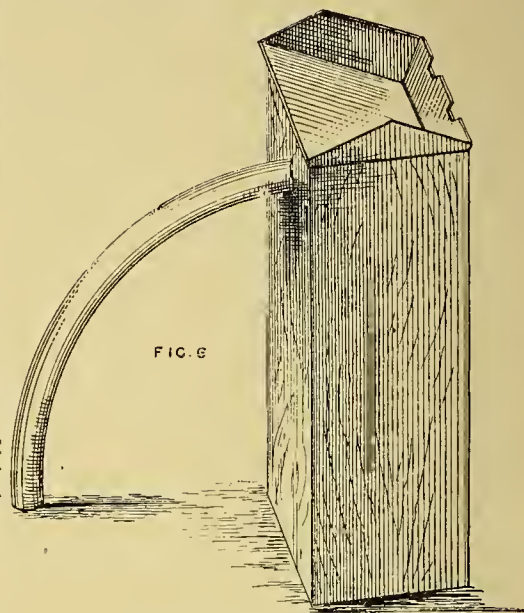
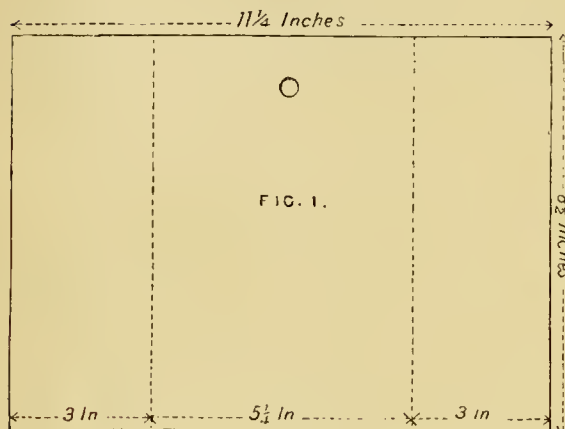
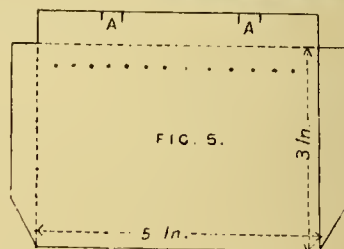


FIG. 2.



Amateurs will find that it will be worth their while to try this apparatus, if they have not already one of the more expensive washing-boxes.

It is, perhaps, unnecessary to say that the capacity of the rubber tube must be somewhat larger than the stream from the tap, so as to have it empty the box.

The apparatus complete is shown at Fig. 6, and if any reader should find a difficulty in its construction, I shall be pleased to come to his assistance through the medium of "Amateurs in Council."



## DETECTIVE CAMERAS.

By AN OLD HAND.

**U**NDoubtedly the craze among amateur photographers runs for the nonce in the direction of instantaneous work, either with or without the so-called "detective" but better named "hand camera."

It is equally a fact that this craze has resulted in much plate spoiling and in the production of prints from negatives, the proper place for which would have been the waste-box. This is not so much the fault of the apparatus, or the want of ability on the part of the artist, but rather the want of adaptability of most of the forms of detective cameras to purposes other than those for which they were designed.

During the past eighteen months I have made it my business not only to examine, but also to carefully test, a very large number of detective or hand cameras, and I propose in a few words to give your readers the benefit of my experience.

Several of the more costly and pretentious of these articles I condemn chiefly on account of their bulk and weight, and as no one believes in the portage for pleasure of cases as heavy as the sample bags of a dry goods traveller, I will dismiss them as outside the question.

Others, again, in spite of their vaunted simplicity, are complicated pieces of mechanism, liable to get out of order with the least inattention to details, and in a particular instance I have on record, actually unusable in damp weather—of these I shall not speak.

In practice I do not find the roller slide with its coil of tissue, giving an almost endless number of exposures, quite the "joy for ever" that its advocates in the advertising columns would make us believe. It is perfectly true there is a great saving of weight as compared with glass, but pnt against this a few peculiarities of the coil of film paper, which are only discovered by experience, and the extra few pounds will be chosen in preference.

Films when reduced in price are, no doubt, the future medium of support for the sensitive tissue. If it were not for the extra cost, I prefer

Fry's films to glass; they are carefully cut and of sufficient substance to retain an even surface in the slide. The Vegara films appear to be thinner than Fry's, and more inclined to cockle in the slide, besides, they are so carelessly cut that a pair of scissors is quite a necessary adjunct to their use. Both Vegara's and Fry's appear to give equal results so far as clearness is concerned, the medium having much the appearance of a very finely ground-glass focussing screen.

The acme of perfection in hand or detective cameras will probably be reached when an apparatus is produced, in bulk, when closed, no greater than a fair-sized pocket-book, in which these films can be inserted in slides little thicker than an ordinary envelope.

Two kinds of lenses are in use with these detective cameras, viz., a form of Rapid Rectilinear and a wide angle lens working at fixed focus. Of the two the R. R. is to be preferred, as it gives a greater depth of focus and a picture more true to nature, but an objection to it is that the object to be taken requires focussing for perfect sharpness, and this adds not only to bulk but considerably to the time needed for preparation.

The lens working at fixed focus is always ready for action on objects beyond a given distance, and this is essentially in its favour; on the other hand, it gives a slightly flattened field to the distance, if I may use such a term—for instance, take the view of a plain with a sharp high hill in the background; the hill will appear on the plate of less height in proportion than as seen in nature. To overcome this I have adapted my Shew's Eclipse to take either a R. R. or the lens supplied by the makers.

The "Kodak," that much-advertised apparatus of the Eastman Film Company, has some good points. It is compact and self-contained, the lens is good of its kind, and it does not very easily get out of order. Yet taken at its best, the Kodak is a mere toy, producing pictures only  $2\frac{1}{2}$  inches diameter, that is,  $\frac{3}{4}$  inch less than the standard lantern slide. There is no provision for working anything but the band of film or paper support supplied by the makers, the

development of which is by no means the simple operation it professes to be.

McKellen's Detective Camera, sold by Marion, is one of the best form of box hand cameras in the market. It is fitted to look like a dispatch box or dressing-case, but it is quite certain that whether in the form of dressing-case or luncheon basket, the way these things are handled by nineteen out of twenty people completely does away with the disguise.

Kruegener's Book Camera, also sold by Marion, answers the purpose of a detective camera, but the pictures it takes,  $1\frac{1}{8}$  inches by  $1\frac{1}{8}$  inches, are even smaller than those of the Kodak, and quite useless for general work. It holds twenty-four of these plates, and their consecutive exposure is simple and ingenious.

Marion's Parcel Detective is another form of camera that tries to hide its identity. It carries quarter-size plates, and is an instrument of great value as a detective camera pure and simple. The plates are carried in light-tight bags, and inserted in position in a very simple way. Unfortunately the Parcel Camera does not admit of being carried in the pocket, and no lens other than the one supplied with it can be used.

Watson's Detective, like all their goods, is finely made and does its work well, but it is both bulky and heavy, and calls for no special comment as regards novelty.

The Vest Camera (Stirn's Patent), the only really secret camera, is for general work a mere toy, but does detective work fairly well when its simple action is understood. The pictures are very small.

A new quarter-plate camera by Perkin, Son, and Rayment, called the "Optimus Detective," is likely to become very popular. There are no dark slides, and twelve plates can be exposed in succession by the simplest action. There is no complicated mechanism, and the lens is of the usual first-rate quality of the "Optimus" brand. It can be adapted for either snap or timed exposures, and can be fixed to a tripod stand. The same firm have also introduced a camera for general purposes, which, though it does not come under the heading of a detective camera,

is worthy of note here, because the single instrument combines the uses of several. It is called the "Optimus Extension Camera," but the name is hardly comprehensive, seeing that besides being a camera capable of the fullest extension, it adapts itself, also, to the shortest focus and widest angle lens, and is so contrived that the baseboard shall not in any way obstruct the field. The alteration from full extension to short focus is completed in less time than it takes to tell, for by the turn of a screw the rack work is thrown out of gear and the whole closes up. It is readily adapted for copying same size, for enlarging or reducing, and altogether, in point of finish, durability, and general excellence, fairly beats the record.

Shew's Eclipse Hand Camera, while proclaiming its intentions, is, in practice, one of the best and most generally useful of all the hand cameras. It is ready for action in a few seconds; and the lens is a thoroughly good one and very rapid. The shutter is a simple one, and not easily put out of order—in fact, I have worked one for the last eighteen months without a hitch. I have had fitted to mine (quarter-plate size) a small R. R. lens of 5 inch focus, with rack adjustment. I can, therefore, use it for ordinary work by merely shifting the lens, fixing it to a light stand, and focussing the object. I am so satisfied with this arrangement that I purpose making it my sole companion on a tour of some extent. As to portability, the camera with one slide or the focussing glass folds up small enough to fit one coat pocket, and the other two double slides are as conveniently stored in another. I never use the leather case, but protect the camera from injury with a wash-leather bag.

With Shew's Eclipse Detective and Edwards' Ischromatic Plates, I have secured good snap-shot pictures on a dull day, when instantaneous work seemed absolutely out of the question.

I purpose later on, with the Editor's sanction, giving instructions (illustrated) for the making of a simple yet efficient form of hand camera, based on the assumption that such a camera must be useful for other purposes than mere snap-shot work.

## LEATHER WORK: A NEW PROCESS.

By "MALLEATOR."

N this paper I offer a few remarks upon a process of ornamenting the surface of leather, which, as far as I know, is altogether different from the usual methods.

Some time ago I required a piece of embossed leather which would stand handling, and having tried the ordinary process of damping and impressing with various punches, wheels, etc., and failed to produce anything that would fulfil the required condition, I made the experiment, of which the following is a description. I may add that the leather article I needed was required to be of comparatively soft and pliable material having no solid foundation, as in book-binding, etc.; therefore it was necessary to emboss the surface in such a way that the various markings, figures, etc., should be entirely independent of such stiffening as paste or paper. I may also mention that it was desirable that the work should be "*antique*" in style, in order to suit its surroundings.

I give these particulars because I believe that some persons who work in ornamental leather often experience difficulty, or, at least, trouble, in obtaining results pliable in material and antique in appearance, whereas by the process which I suggest both are secured by the one operation.

I do not mean to convey that this process is applicable only to work which is necessarily pliable and which is to be unmounted. On the contrary, I consider it most suitable for such subjects as panels, book covers, caskets, etc., etc.

A high degree of relief, of course, cannot be obtained in leather-work without a press or stamp of some kind, or without cutting and padding—which latter is a most effectual and effective method, and about which, with the Editor's approval, I hope to have something to say later on—so I only claim for my process, that by its means clear and sharp results may be secured which shall not vanish, upon the leather being handled, and which shall possess at the same time an *antique look*, provided always that the

design and workmanship be in keeping with that idea.

The example which shall serve to illustrate my meaning in this paper (Fig. 1) is a simple design which may be found useful for various purposes, such as a blotting-book cover or back for photo frame (when will manufacturers learn that the back of anything which claims to be artistic is as important as the front?), it is, however, meant merely as a "peg" upon which to hang suggestions.

The essential points in which this process differs from those usually employed are that during the operation of embossing, the leather is attached to a layer, or shallow bed of a yielding composition, and that the tools are applied at a considerable degree of heat, the effect of which is that the leather is made, within certain limits, to assume any desired form, and, also, its texture is so affected that it will retain that form after removal from the composition.

Supposing, then, that we have selected a design, the other requisites are a piece of flat board, some composition, and one or two very simple tools, to be described presently.

The board is to be a little larger every way than the design; a piece of  $\frac{1}{2}$  inch or  $\frac{3}{4}$  inch deal will suit.

The composition is made up of pitch, three parts, resin, one part, a small quantity of Venice turpentine, say, quarter part. Melt all together in an iron vessel, and, when melted, add two parts French chalk and stir well. When these ingredients are thoroughly amalgamated, stir with a wax (paraffin) candle until the portion used in stirring is melted, let the mixture cool slightly, and when about the consistency of thick treacle, pour upon the board and with a broad knife spread evenly to the depth of about a quarter of an inch.

The surface should be as flat and smooth as possible, and to ensure this, and also to prevent the mixture setting too quickly, the knife blade should be heated.

Leaving this aside to become hard, we now turn our attention to the most important item of all, namely, the leather.

The kind of leather will, of course, vary





FIG. 1. DESIGN FOR LEATHER WORK.

with the use to which it is to be put, but for the present we shall confine ourselves to that which is easiest to work, viz., the thinnest cowhide procurable. For small subjects, the lighter portions of the skins, which are used for lining boots, etc., and which are very easily procured, will suit admirably, but care must be taken to select a piece of even thickness and which is quite smooth on the back.

Cut a piece a little larger every way than the design, and dip it in warm water in which some washing soda is dissolved. The water should not be hotter than the hands can bear.

Now place the leather upon a flat board or table, being careful not to stretch it in any direction, and wipe it with a dry cloth on both sides.

Assuming that by this time the composition is quite cold, next hold it before a fire until the

Now remove the pattern and there should be a fac-simile of the design upon the damp leather.

The tools required are very few indeed. I hardly ever use more than one, and I strongly recommend it, as a tool which will trace straight or curved lines, smooth surfaces, and also model, with equal ease. This tool is simply an old "riffler," having the roughed parts smoothed down, and in case any reader may not be familiar with this very useful little instrument, a sketch of it is given at Fig. 2.

This tool is about six inches long, with spoon or paddle-shaped ends, one of which is straight, while the other is slightly bent. Both ends may be made quite smooth by removing the file surface upon a stone and polishing with emery, but the curved end will be found most useful, being possessed of all the qualifications enumerated above. The riffler may be obtained

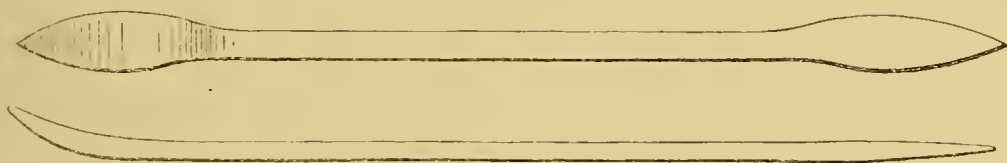


FIG. 2.—SHAPE OF TRACING TOOL.

surface is slightly melted or just bright, and place the leather quickly but evenly upon it; press it firmly all over with some smooth flat instrument, such as a paper-knife; see that the edges adhere all round, if not, raise the edge and again hold that portion of the composition to the fire, and fix.

In heating it is only necessary that the surface should be affected, in order that the leather may adhere *lightly*, and the heat should not be sufficient to soften the mass of composition.

If a little French chalk be rubbed on the composition which is not covered by the leather, it will prevent it sticking to the hands, etc.

Now place the design upon the leather, secure it with a few pins at the edge to ensure its not moving, and with an agate tracing-point, or with a smooth pointed knitting-needle, go over all the lines of the design, using a ruler for all straight lines and tracing all details firmly and continuously.

at any shop which provides sculptors' or wood-carvers' tools; and here I may mention that Messrs. Booth Bros., *Stephen Street, Dublin*, supply all requisites for leather-work.

The only other tool required, at all events, to make a beginning, is a grounding punch. This is the same tool as used for wood-carving ground-work, and may be of any pattern, but the best for our present purpose will be a rather roughly-pitted punch, or any of the coarser "matting" tools as used for repoussé work will answer admirably.

Another requisite which I omitted to mention will be a small spirit lamp with which to heat the tools.

Having traced the design, the next step is to go over all the lines with the tracing-tool, the point of which must be heated, in order to emphasize the markings and guard against their becoming obliterated.

The leather should be kept damp by the



application of a rag or sponge dipped in water in which some washing soda is dissolved, and if a small quantity of glue or size is also added it will serve to stiffen the work, but the leather should be merely damp, and the tool as hot as the leather can bear without burning. To ensure this correct amount of heat a small piece of damp leather should be kept upon which to try the tool, or a margin may be left upon the work for this purpose.

Having gone over the design with the hot tool, you may now proceed to the work proper, which consists, first, in accurately shaping the outline and then modelling the subjects, such as leaves, fruit, etc., in the example before us.

Commencing with the main stalk, indent the edges with one side of the tracing-tool, moving it slowly so that the heat may penetrate to the underlying composition. When the latter is felt to yield slightly, by a scraping movement of the edge of the tool towards the stalk, or other portion in hand, the composition may be made to fill the part to be in relief, leaving a corresponding depression in that portion of, what we may call, the background, from which it is taken. When this is done, pass on to a fresh part, allowing that already treated to cool and harden.

When the whole design is thus treated the lines are again gone over, and the worker should endeavour to get his subject as sharp in outline as possible, and also that the background spaces may be flat and of the same depth throughout, but not interfering with the raised parts for the present.

When this has been accomplished allow the work to become thoroughly cold, when the operation of modelling the leaves, fruit, etc., may be proceeded with.

The convex side of the tool will be found most expeditious for this purpose, being used as hot as possible—consistently with the caution already given—and applied with a firm touch, but not so as to interfere with the outline.

While the worker in this operation must endeavour to give shape to his subject and “invest it with artistic merit,” as the sculptors say, he must bear in mind that his object is not

only to model, but also to treat the whole surface of the leather with the hot tool, the heat of which must be sufficient to alter the texture of the surface without burning, so that upon being removed from the temporary foundation of composition it shall retain its form.

With regard to modelling, no definite directions can be given. This is a matter which entirely depends upon the artistic talent and skill of the worker. However, in such examples as the present correctness of outline is the more important matter.

The next operation is the impressing of the background, and here I would repeat my direction as to heating of the tool—namely, that it should be as hot as the leather will bear without becoming charred, and also my advice to try the tool after each fresh heating upon a separate piece of leather.

Having selected your grounding-tool, heat it and apply to the background with a firm pressure, working right up to the outline of the design, but being very careful not to encroach upon it.

The grounding should be uniform in pattern, that is, the indentations should not be crowded together in one place and scattered in another. The ground should also be even, not being more deeply impressed at one portion of the work than at another.

Care must also be taken lest by repeated applications of the hot tool the composition become too soft; if this should happen the work must be suspended at that part and carried on at another.

When the background is impressed the outline of the design may be again gone over, and any disturbance which may have been caused by the last process rectified.

Finally, the work should be set aside until thoroughly cold, when it may be removed from the composition bed. This must be done by carefully raising one edge and peeling off with an even pull, when, owing to the presence of the French chalk in the composition, the leather will easily part company with it.

Should it be deemed desirable to “touch up” any of the parts in relief, fold a towel or duster



in four, place it upon a table, and lay the work face downwards upon it; now apply the convex side of the hot tool to the parts to be improved with a gentle but firm pressure, being careful to avoid over-doing.

Should this operation be resorted to, it will be necessary to retouch the outline of the parts upon the right side of the work. This is done by replacing it upon the composition, which must first be made smooth with a hot knife, as before directed, and applying the edge of the tracing-tool.

The panel, etc., may now be cut out with a sharp knife, and is ready to be applied to whatever use it may be intended for.

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## GALVANIC BATTERIES.

By ALLAN TRAYNOR.

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### IV.—THE LECLANCHE CELL AND ITS CONSTRUCTION.



THE LECLANCHE CELL.—The Leclanché cell is the most generally used for electric bell work, telegraphy, and telephony. It is in two forms. In one form a porous jar is employed, in which there is a plate of carbon, with small pieces of broken carbon firmly packed round it. Finely crushed oxide of manganese is sifted among the pieces of carbon, and the jar is sealed with pitch—a small hole being left to permit the escape of gas. The form of porous jar is shown at Fig. 11, A.

The positive element is zinc, usually in the form of a rod, to which is soldered a short length of cotton-covered wire, with a loop at the end for connection.

The containing vessel (Fig. 11, B) is usually of glass, the outside and the inside of the rim being covered with paraffin wax to prevent the creeping over of salts.

In the other form of the Leclanché the porous jar is dispensed with. The crushed carbon and manganese are pressed into solid blocks (Fig. 11, C), and the plate of carbon placed between them. Stout bands of indiarubber are employed to bind the blocks and the carbon together.

Rubber bands are sometimes used with rings upon them, through which the zinc rod can be passed and held in position without touching the blocks.

The exciting liquid for both forms of cell is a solution of crushed sal-ammoniac, the quantity varying with the size of the porous cell or the agglomerate blocks. The sizes are known as No. 1, No. 2, and No. 3, and the quantity of sal-ammoniac required for each is 3 oz., 4 oz., and 6 oz., respectively. To charge the cell, the porous jar (or the agglomerate blocks and carbon plate, as the case may be) is first placed in the outer containing vessel, the powdered sal-ammoniac and zinc rod added, and the jar three-quarters filled with water. After standing for about eight hours, it is ready to work. If agglomerate blocks are used, the cell will work at once.

The proper work of this cell is to yield a small *occasional* current: hence it is admirably suited for working signals, electric bells, telegraphs, and telephones. For cases requiring a long-sustained current, as in electro-plating, electric lighting, and working electro-magnets, it is useless. When once charged and set to its proper work, it will work for a long period of time without attention. The average life of the Leclanché is about eighteen months, although instances have been known where cells have worked from two to four years. Under whatever circumstances the cell may be working, the current generated depends on the quantity of material used in its construction. This, of course, will exhaust itself sooner or later, according to the work done.

The Leclanché should always be kept in a cool place. If kept in a room under conditions of varying temperature, the exciting liquid becomes dried up. To replenish it, all that is required is water. The most convenient size of cell suitable for most purposes is No. 2 of either form. Where cost has to be considered, the outer jar of glass may be dispensed with, and ordinary jelly jars used instead. Before charging the latter they should be carefully examined for any cracks or irregularities through which the liquid might leak. A coat or two of

Brunswick black should be applied, one inch deep, outside and inside the rim. This takes the place of the paraffin wax upon the rim of the glass containing vessels. As to the zinc, authorities differ as to whether it should be amalgamated or not. The writer advises amalgamation in all cases. Where saline solutions are employed, amalgamation may not be absolutely necessary; but it is much cheaper in the end, as the zinc is thereby preserved, and the trouble likely to arise from local action avoided.

When the liquid in a Leclanché battery becomes low, only water should be added. This addition, however, will not be frequently neces-

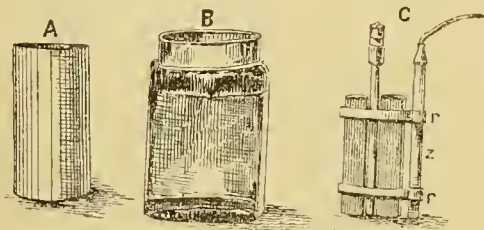


FIG. 11.—THE LECLANCHE CELL.

A, Porous Jar; B, Containing Vessel; C, Carbon Plate between Blocks of Manganese; Z, Zinc Rod passed through rings in the rubber bands, r, r.

sary, if the battery be kept in a cool place. In replenishing with water, never fill the cells more than three-quarters full, and have the water in all the cells the same height. Care must also be taken not to wet that part of the zinc and carbon elements (more especially the latter) which are to be out of the liquid. If the battery be placed in a box which can be tightly closed, evaporation goes on very slowly, and the trouble of replenishing with water is reduced. After about one year's work, a fresh quantity of sal-ammoniac may be necessary; and if the zinc be very much worn, a new rod will be required. Should the battery show signs of exhaustion with fresh zinc and fresh solutions, the porous jars or agglomerate blocks are likely to be the seat of the fault, and are better replaced with new blocks or jars entirely.

The plates of carbon may be used for an indefinite time.

## THE AMATEUR DEMONSTRATOR.

LIGHT (*continued*).

By OLIVER BECKERLEGGE.

IV.—COLOURS: PRIMARY, SECONDARY, TERTIARY—DIFFERENT REFRACTIBILITY—NEWTON'S PRISM—HOW TO MAKE A HOLLOW PRISM—PURE COLOURS—COMBINATION OF PRISMATIC COLOURS BY MIRRORS TO RECONSTRUCT WHITE LIGHT—COMBINATION OF COLOURS BY THE REVOLVING DISC—MONOCHROMATIC LIGHT—HEAT INVISIBLE RAYS—ALUM TROUGH—CHEMICAL RAYS—PHOTOGRAPHY—SALTS OF SILVER—EXPERIMENTS WITH MAGNESIUM LIGHT—THE SODIUM LAMP—YELLOW FOGS AND PHOTOGRAPHY.



IN dealing with reflection, we have seen that the form of bodies, with all their irregularities and diversities of surface, are made manifest by the varying power of the object to reflect light. But in most objects there is more than form distinguishable; we perceive colour.

Let us break up a beam of white light, and we shall find it is made up of three colours, which being mingled together, make all the varying tints which nature and art can present. As a rule, we speak of seven colours, viz., red, orange, yellow, green, blue, indigo, violet; but these are all compounded out of red, yellow, and blue. For example, red and yellow = orange; yellow and blue = green; blue and red = indigo or violet, mixed in varying proportions. These four colours are called secondary. A tertiary is produced by three combined. In art it is not advisable to use more than three, as the colours become opaque and heavy. The reason of this is, that we cannot start with pure colours; in all pigments there is another colour than that which predominates. For example, take a red, and according to the power of the eye to discriminate, we shall probably see that the colour leans either to scarlet or crimson, which simply means that in the red there are either yellow or blue rays blended with the red.

If we take a pencil of light and cause it to pass through a prism, we find that some of the colours meet with greater resistance than others, consequently are bent further from a straight line. Newton was the first to demonstrate this. Useful prisms may be made thus:—Procure

from a second-hand dealer a "drop" of a "lustre"—a broken one will serve our purpose. With a three-corner file cut a line on its three sides; by the application of heat, a fracture will take place; with care, several prisms may be got out of one "drop." For experimenting, these will do as well as more expensive ones procured from an optician.

From what we have already seen, the greater the density of the medium, greater will be the dispersion. In other words, the three primary colours will be removed further from each other, and the spectrum will be longer.

Whilst we are on this subject, I would say a word about making a hollow prism. These are rather expensive articles to purchase, but may be made with little cost and trouble. I have made one to use with bisulphide of carbon, which has great dispersive power. A hollow prism has this advantage, that any liquid can be used, and thus the different refractive powers can be demonstrated.

Proceed as follows:—Cut a prism in wood of the exact size desired, squaring off one end; a convenient size to make will be one with each angle  $1\frac{1}{2}$  inches—it will be more difficult to make one much smaller than this. Place the end of the prism on a piece of stout sheet brass, say,  $\frac{1}{8}$  inch thick, and mark and cut out a shade larger. Drill a  $\frac{1}{4}$  inch hole in the centre, through which pass a wood screw and secure it firmly to the prism. File it up true. Cut and file up three strips of brass,  $\frac{2}{3}$  inch wide, and a trifle longer than the sides of the prism. Lay these on the plate, and firmly solder them with the bottom edge flush with the plate. When one has been properly done, file off the ends true with the model, and solder on the second, and then the third. By working on a mould the side of the cell will be kept true, and the whole thing can be easily manipulated. Working without it, I found no end of trouble; the extra time taken in making the wood model is more than gained in our after-work.

Two of these cells must be made. The holes in the cells must be tapped with a fine thread. Select a piece of glass free from veins or striæ, and cut three pieces,  $1\frac{1}{2}$  by 2 inches. The two

long sides of each piece must be ground away at an angle, so that when placed in the cell a fair joint will be made.

I got a lapidary to grind some for me on his lap; but with care they can be ground on an ordinary grinding-stone. For bisulphide of carbon I have found good glue answer; cement composed of indiarubber is of no use, as it would be dissolved by the bisulphide. At the same time glue would not answer for water; but if a little bichromate of potass were dissolved in the glue, it would be waterproof, as light acting on the potass renders it insoluble.

Touch the edges with glue and bind the pieces together, seeing that they all fit into the cell, and place in a good light to harden. When hard, run a little glue down the angle, to prevent any possible leakage. This must be done one joint at a time, else the glue will run on the face of the glass. When the joints are hard we can proceed to fix in the cell.

Before proceeding further, we must make a plate to form a foot for the prism to stand on. In the centre of a plate, say, two or three inches square, solder a stud with a thread on it to fit the hole in one of the cells. Oil the stud and screw it in its place. Make the cell warm, not hot, and pour sufficient glue in to half fill it. Now put the prism in its place, being careful that it stands perpendicular with the cell, and let it stand in the light to harden.

On the outside of the other cell I soldered a boss, and bored and tapped a hole. Also, I made a screw plug, to screw into it, as shown, A, Fig. 18. Between the boss and plug I placed a washer of cork. Supposing the glue in the bottom is hard, we can put on the top. The plug must be left quite  $\frac{1}{2}$  inch long and be well oiled. The cell must be half filled with the glue, and the prism fixed in it, and placed on one side to harden. When this is the case, the plug can be withdrawn, and we shall have a hole through the glue, by which, with a small funnel, we shall be able to fill the prism. If our work has been carefully done, we shall have a very useful cell, impervious to even bisulphide of carbon, as I can speak from experience. For the benefit of inexperienced experimenters, I may say that this



fluid is highly inflammable and the prism must not be filled near artificial light; and great care must be exercised in using it—as in addition to danger, from its inflammability, it has a most offensive smell.

By filling it with different kinds of fluids, we shall see their dispersive properties. Now, if by the means indicated, we can analyze light, and discover its elements, can we work backwards, and by synthesis produce white light? Experiments will show that this is possible. The first thought that occurs to one, perhaps, will be this: Suppose we take the three primaries in form of paint, and mix them together, then we shall get white paint. Well, in theory it should be so, but in practice it is not, and perhaps for this as the principal reason, that no pigments prepared by the artist are sufficiently pure. But that the results can be obtained by other means, we shall demonstrate.

Fix a prism, *a*, Fig. 19, in front of a point of brilliant light issuing from a small opening. Make seven small mirrors out of a looking-glass, and fix them on a stand, as 1, 2, 3, 4, 5, 6, 7. Place a screen, *c*, in some convenient place, so that a little mirror placed in the path of the red of the spectrum shall reflect it on the screen. Place the other six mirrors so that they shall reflect the other rays on the same spot. The result will be that the blending of the colours will produce light. Of course, there will be a considerable loss of light. But the result can also be secured in a more mechanical manner. The apparatus I am now about to describe is exceedingly useful for many optical purposes. I made it many years ago to use with vacuum tubes; but it has come in useful for many other purposes.

In a baseboard, 15 inches by 10 inches, two standards are firmly mortised. These standards are joined together by two blocks, as shown in Fig. 20, *a*, *d*, which are mortised into the standards; *a* is a wheel turned out of mahogany, with a spindle or shaft of  $\frac{1}{2}$  inch brass-tubing. Run a wood screw into one of the standards, in the diameter of the hole to receive the spindle, and on the spindle cut a groove with a rat-tail file, so that the groove may engage the screw;

this will prevent the wheel from being withdrawn, *b*. At the top of the standards, two  $\frac{1}{2}$ -inch holes must be made; care being taken that the centre of each hole is the same distance from the baseboard. A Vent is made down to the hole, and wedges are made to fill up the space, *x*. Another spindle, *c*, is made of brass-tubing; on one end a small pulley is fixed, on the other a large disc, *r*, say, 14 inches diameter. Drop the spindle in its place, so that the pulley is in line with the driving-wheel. A screw can be made to engage a groove in the spindle, so as to prevent displacement. The wedges must be fastened by a screw, as shown. A handle is fixed to the driving-wheel, and a cord passes over it and the pulley. We shall now be able to drive the disc at a considerable speed.

Now take a sheet of good earboard, and strike a circle 14 inches diameter, and divide it into four equal parts; each quarter must now be divided into seven parts. Each of these divisions must be coloured as near as possible to the colours of the spectrum—red, orange, yellow, green, blue, indigo, and violet, *r'*. Place the disc on the machine and rapidly turn it, when we shall find the distinctive colours fade away and give place to a more or less white disc. I have never been able to get a pure white, for the reason before given, but a very light grey, nearly white.

The reason of this is obvious, as most of my readers will be aware of the persistency of vision. When light emanating from an object falls on the retina of the eye and sets the nerve-filament vibrating, they will continue to vibrate for an appreciable length of time, even after the exciting cause is removed, perhaps to the extent of one-tenth of a second. Now, if an object falls on the retina fewer times per second than this, we perceive the object in distinct flashes; but if more frequently than this, then we perceive a continuous picture. In the case before us, the whole of the seven colours will fall on the same part of the retina so rapidly, that the seventh covers it before the impression of the first has passed away; so that, practically, the seven colours are superimposed,

or, if you will, mixed together *in the eye*, the result being white light, or an approach to it, dependant on the purity of the pigments used. It is difficult for some people to realize that there is no colour in the object seen, but that it depends on its property of absorbing some rays and reflecting others. Suppose light were composed simply of one colour, then all nature would be of varying tones of that colour. A simple experiment will make this clear. Spirits of wine, as most are aware, when burned in a lamp, gives an intense heat, but hardly any light. Now, if a little salt is dissolved in the spirit, it will give an intense yellow flame. Whilst the coloured disc is on the machine, view at with this monochromatic light, and lo! all the red and blue have disappeared, have turned black, and the green and orange have turned grey. Why is this? Simply because some parts of the disc have been prepared to absorb yellow and reflect red and blue; but as there was neither red or blue in the light, these parts absorbed the yellow and had nothing to reflect; consequently they appeared black, whilst both the orange and green contained a portion of yellow, which, however, is so feeble that, by contrast, it seems only grey. Place the lamp before a person's face; the countenance is robbed of its flesh colour, and has the appearance of a corpse. Now, if the disc is treated with any other coloured light, red, for example, all colours but this will be quenched. It will be understood that an ordinary lantern with a coloured glass front will answer all the same purpose, and by varying the colour of the glass, we can demonstrate the effects of the various colours. One fact must be taken into account, that in experimenting with coloured lights, the ordinary lights must be either extinguished or lowered, else the various surfaces will reflect their colours obtained from such sources.

In our analysis of light, so far, we have only had to do with one set of phenomena, viz., colour. But there is much more than this. There are two sets of invisible rays, with the colour-rays lying between them. At the red end of the spectrum are heat rays, and at the violet end actinic or chemical rays. Everyone is

familiar with a "burning-glass," so called. A lens not only converges the luminous rays, but the heat. Let us throw with a prism a spectrum of light on a screen, and place a thermometer, first at the red end and beyond, and again at the violet end and beyond, and we shall discover a sensible difference in the temperature.

It is possible to filter out or quench the heat rays without destroying the luminous rays; and this, under some circumstances, is a very desirable thing. Take off the front of the lantern, and place the bulb of a thermometer in the focus of the condenser, considerable heat will be manifested.

Make a cell thus: Cut two pieces of glass,  $3\frac{1}{4}$  inches square, and three pieces of mahogany,  $\frac{1}{2}$  inch square. With rubber-cement fasten these to the glass, so as to form sides and bottom. We shall now have a useful tank,  $2\frac{3}{4}$  inches by  $\frac{1}{2}$  inch, inside. If this tank is filled with a saturated solution of alum, and placed in front of the condenser, we shall find that whilst the luminous rays pass without interference, the heat rays are arrested or quenched.

But, in addition to luminosity and heat, we have said there is a third principle, viz., actinic. For a long time it has been known that some property in light, acting on certain substances, changes their colour. The earliest instance that came under the writer's notice was some forty or more years ago, and is only worthy of notice from a scientific point of view. A business card had been framed and hung in a window looking due south; by some means, when disused, it came into my hands, and on taking it to pieces, I was much surprised to see the matter distinctly figured on the wood. The light had passed through the paper and darkened the wood, whilst the black letters preventing the passage of light, left the wood much lighter, the effect being light letters on a darker ground. On this property of light the whole art of photography depends.

This is not the occasion to discuss the various salts of silver, etc., used in the process; but an experiment may be easily performed which will illustrate the subject.

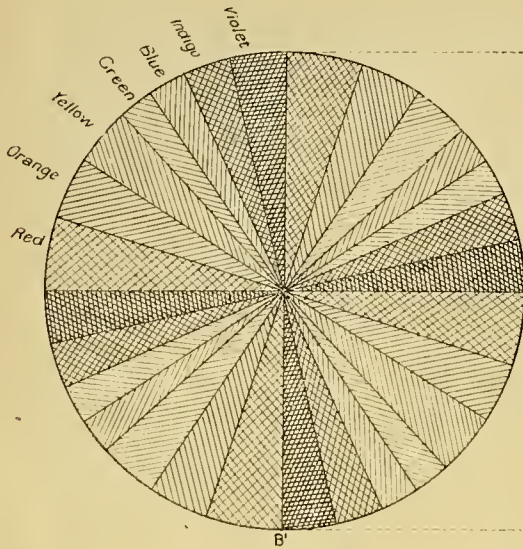


FIG. 20. Apparatus for revolving a disc with the prismatic colours, for the purpose of resolving them into white light

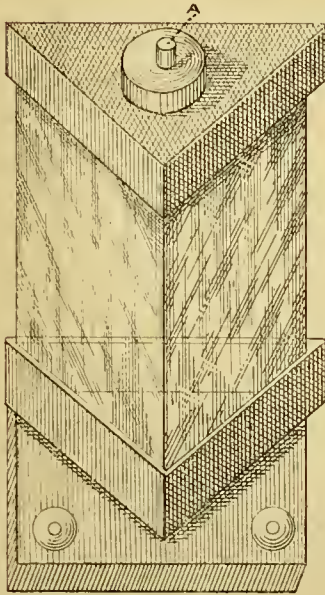
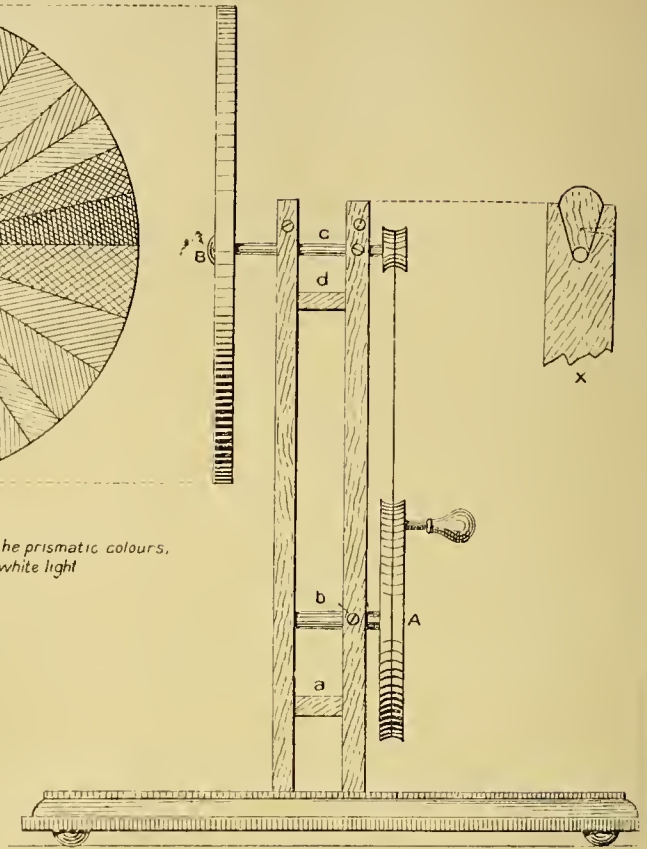


FIG. 18. A hollow prism.

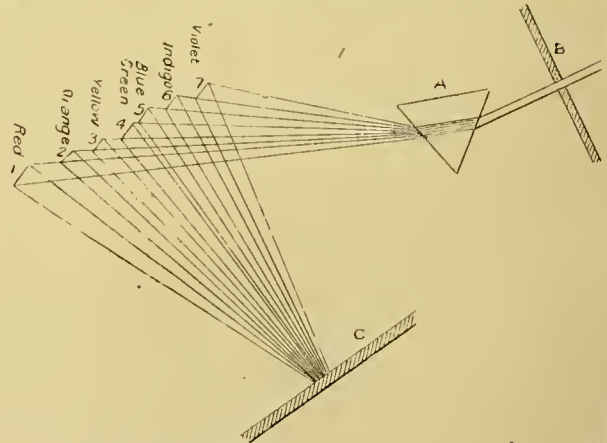


FIG. 19. A beam of light is refracted and dispersed by a prism at 1 2 3 4 5 6 7. Small mirrors are placed so as to receive the rays and reflect them to the same point on the screen C, when being recombined they form white light



Procure from a dealer a sheet of sensitized paper. On a portion lay a piece of lace, covering it with a sheet of glass, which must be pressed closely to the lace. If this be now exposed to the yellow light from our sodium lamp, no change will take place; if, however, we expose it to daylight, or to the light of burning magnesium ribbon, all the unexposed portions will be changed, whilst those parts covered by the threads of the lace will remain unchanged, and we shall have a pattern of the article photographed.

In the first instance, there were no actinic rays in the yellow light. For this reason a photographer has his "dark" room lighted with a window of yellow glass, or ordinary glass covered with some yellow material; for not only does yellow light contain but feeble actinic rays, but the same rays are filtered out of light, or quenched by passing through a yellow medium.

We can now understand why it is that certain times of the year and conditions of the atmosphere rendered photography difficult to the early workers in this art. But as it has been discovered that both the electric and magnesium lights are rich in chemical rays, the operator is rendered independent of atmospheric conditions.

## NOTES ON NOVELTIES.

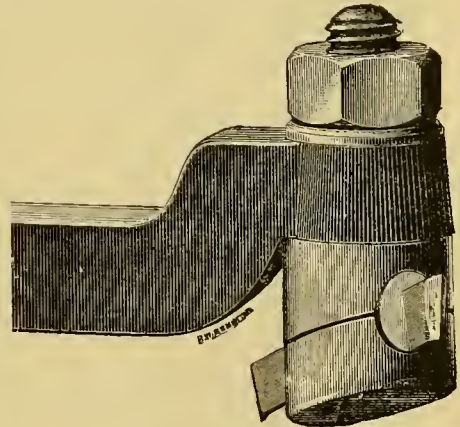
By THE EDITOR.

16. THE PEOPLE'S FRIEND. 17. TURNING LATHES. 18. THE "CLIMAX" TOOL-HOLDER.

16.  HE PEOPLE'S FRIEND.—This is the name of an excellent weekly miscellany of popular and instructive literature that is well known and much appreciated by our friends over the Border, and certainly deserves to be equally well known here. Besides two serial tales by good authors, it contains a varied collection of interesting matter, amongst which is a column entitled "Our Evenings at Home," showing how to construct parlour games. It is one of the best penny-worths that I know of, and readers would do well to send for a specimen copy. It is published by John Leng and Co., Bank St., Dundee, and the London office is 186, Fleet St.

17. *Turning Lathes*.—Larkin's well-known manual bearing this title, published by the Britannia Co., Colchester, has now reached its third edition. I have already given unstinted praise to this work, and have nothing to add, except that for the minuteness and practical nature of its instructions it is one of the best guides to lathe work, in wood or metal, that an amateur can have.

18. The "Climax" Tool-Holder.—The Britannia Co., Colchester, send me a description of a tool supplied by them, of which they say:—The "Climax" Tool-holder is designed to meet the demand for a useful, all-round cutting-tool, which will cut straight or irregular work, and into corners, and face either right or left, without altering its position in the slide-rest. The important improvements in this Tool-holder over those already in use are:—Side rake as well as top rake can be given to the cutter, which thus always presents the correct cutting angle to the work. The object of this side rake is not only to make the tool more keen, without sacrificing its strength, but to relieve the feed screw or gearing of strain by giving the tool a tendency to feed along



THE "CLIMAX" TOOL-HOLDER.

and into its cut. The cutter is held perfectly rigid in any position by tightening a single nut. This holder is invaluable for screw-cutting, as the cutter can be canted to suit the angle of any thread either V or square. The "Climax" Tool-holder is made entirely of steel, the bolt, etc., being case-hardened, and is of the best workmanship and finish. The cutting-tools are of uniform section, made from the finest cast steel obtainable. Cutters of Mushet's special self-hardening steel can be supplied for the two larger sizes. This steel is strongly recommended, and machine tools should be worked at faster speeds, and with deeper cuts when using it. These Tool-holders will be delivered free per Parcels Post at the following prices:—

| Section of Cutter.                     | Size of Shank.            | Suitable for use in       | Price of Tool-holder. | Price of best Cast Steel Cutters. Per doz. | Price of Mushet's Steel Cutters. Per doz. |
|----------------------------------------|---------------------------|---------------------------|-----------------------|--------------------------------------------|-------------------------------------------|
| $\frac{1}{8}$ in. by $\frac{1}{8}$ in. | $\frac{1}{8}$ in. square. | Lathes to 4 inch centres. | £ s. d.<br>0 13 6     | £ s. d.<br>0 4 6                           | £ s. d.<br>... ..                         |
| $\frac{1}{4}$ in. by $\frac{1}{4}$ in. | $\frac{1}{4}$ in. "       | " 4½ inch "               | 0 14 0                | 0 5 0                                      | " ..                                      |
| $\frac{3}{8}$ in. by $\frac{3}{8}$ in. | $\frac{3}{8}$ in. "       | " 5 inch "                | 0 14 6                | 0 5 6                                      | " ..                                      |
| $\frac{1}{2}$ in. by $\frac{1}{2}$ in. | $\frac{1}{2}$ in. "       | " 6 inch "                | 0 15 0                | 0 6 0                                      | 0 8 0                                     |
| $\frac{3}{4}$ in. by $\frac{3}{4}$ in. | $\frac{3}{4}$ in. "       | " 8 inch and upwards.     | 1 0 0                 | 0 8 6                                      | 0 11 0                                    |

## AMATEURS IN COUNCIL.

For "Instructions to Contributors and Correspondents," see page 46 of this Volume, or Part 13 (New Series), p. 46.

### Self-Tightening Lathe Band.

OLD IRON writes:—"E. J. WOLFE (p. 46, Vol. II.) seems to misunderstand ELECTRON's plan (p. 468, Vol. I.) of an 'Easy Method of Tightening Lathe Bands.' I take it, ELECTRON's plan proposes a single continuous band, and I should think there is less friction with his double-grooved wheel than with E. J. WOLFE's separate wheels. I followed ELECTRON's plan from memory, and by so doing altered it somewhat. I raised an upright from the left-hand lathe standard, and pivoted the cross lever centrally on this, then hung the double-grooved pulley from the front end and the weight from the back. This saves meddling with ceiling and wall, and allows for moving the lathe bodily. Perhaps ELECTRON will offer an opinion on this. It works very well."

### Lantern for Showing Opaque Objects.

H. S.—This matter is being dealt with by a practical man, so you may expect an article in some future number.

### Advertising Clock.

Co. CAVAN.—Two long horizontal rollers pivoted into brackets immediately behind the front of case, one right at bottom of case, the other high up near movement, each has fixed to it a pulley recessed for a chain like the pulley of a Dutch clock. The upper roller is driven by the clock, and the two are connected by an endless chain, the cards are mounted on tapes or a piece of silk passing over the two rollers. If a star-wheel and jumper are used with the upper roller the motion may be almost instantaneous. Many devices for this purpose have been patented of late years, some being set in motion by electricity. In several, the cards are fixed on rotating drums. One I saw a drawing of had a separate movement to drive the drum independent of clock. See Patent Specification of F. W. Little, 1883, 17th March, No. 1416.—W.

### American Organ and Harmonium Fittings.

B. BROWNSON writes:—"I am much interested in the papers in AMATEUR WORK on 'American Organ Building,' and I expect it will not be long before they are followed by directions for building larger and more complete instruments, such as a two-manual with pedal organ; and for the benefit of your Provincial

readers I might say I have found the organ and harmonium fittings of Messrs. W. H. Spruce and Son, 81, *Rushton Road, Thornbury, Bradford*, to be of the best quality, and well worth using, giving every satisfaction. I am very glad we are going to have papers on the Gas Engine, and I hope they will not be long before they make their appearance."

### American Organ.

H. W.—I think it a mistake to have the bellows too large. It ruins the tone of the reeds; besides, the heavy pressure would be likely to cause them to break. I do not at all see how it is possible to add any more reeds to an instrument, without buying an entire new reed-board. The construction would not allow of it. The only extra which could be added, would be a Sub-bass or an octave coupler, and those only

In February Part, Fig. 12 has too many screws shown. The enclosed sketch will show the error. Also, in Fig. 15, the words "Mouldings, full size," should not be placed so as to refer to the section, M, but only to the one on the left of it.—T. L. WINNETT.

J. H. (Scarborough) writes:—"These papers are admirable, and what many amateurs have long desired. Excellent as were the papers on 'Organ Building' by Mr. Wicks, only a very few (comparatively speaking) could avail themselves of them, simply for want of space to place the organ when built. I agree with the remarks of H. W. (page 143), and venture to state that there are many amateurs who would like to build an American organ with either two or three manuals and pedals, so as to get home practice. May we hope for papers for such an instrument ere long, or

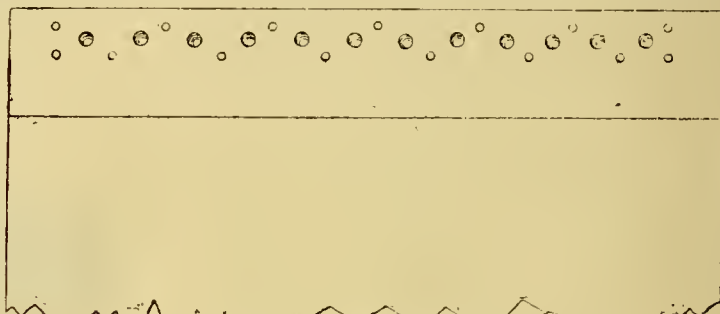


FIG. 12 AS IT SHOULD BE DRAWN.

if room had been allowed previously for the additions. Therefore the number of rows in the instrument must be decided before starting on the work, as they cannot be added afterwards. 2. As to the compass being extended downwards to C, the amateur organ-builder can please himself, but I do not at all see how a second performer could render the pedal part of organ music "exactly as written." What is he to do when the part reaches up to the top C, viz.,



It would have to be transposed to the octave lower, with disastrous results to the intentions of any composer. If pedal music is wanted, have pedals. 3. A divided up and down coupler is the best for the specification of the organ I am describing, but if a full row of 16 feet reeds are used, an upward coupler would be preferable.—T. L. WINNETT.

could Mr. Winnett or H. W. in the meantime give us a section, to scale, showing the action of the different manuals, pallets, and soundboard, and give the measurements of the bellows required for such larger instrument? If so, I think, from the present papers and those by Mr. Wicks, many amateurs could work out for themselves further details."

### Address of Aluminium Manufacturer.

TOM WRIGHT.—The largest and best manufacturers of Aluminium in the United Kingdom are, probably, The Aluminium Company, Limited, who have extensive works near Birmingham and Sheffield. Address the Secretary at the London office, 115, *Cannon Street, London, E.C.*—G. E.

### Makers of Launch Engines.

S. M. LLOYD.—Two firms of repute are Plenty and Sons, *Eagle Ironworks Newbury, Berks*, and Duncan Brothers, *Dundee*. Second-hand launch engines are often advertised in "The Machinery Market," monthly 6d., published at 181, *Queen Victoria Street, E.C.*—J. H.



### Dimensions of Boiler.

LINELLE.—Since you ask for a horizontal boiler, I show one, but vertical boilers have less work about them. The boiler illustrated in the figure is of the multitubular Cornish type, and the dimensions will give you ample steaming power. In large boilers gusset stays are inserted at back and front plates; but by making these plates somewhat thicker,  $\frac{1}{4}$  inch I give, and using stay bolts above, and beading over the tubes at both ends, you may save the trouble of fitting these awkward stays in so small a boiler. In the figure, A is the shell, from  $\frac{5}{8}$  to  $\frac{3}{4}$  in. thick, of a single plate, double riveted, with or without a butt strip; B is the front plate; C the fire-door plate; D the fire-door; E is the back plate flanged

steam. Safety valve, blow-off cock, fusible plug, and other fittings and mountings as usual.—J. H.

### Defective Telephone.

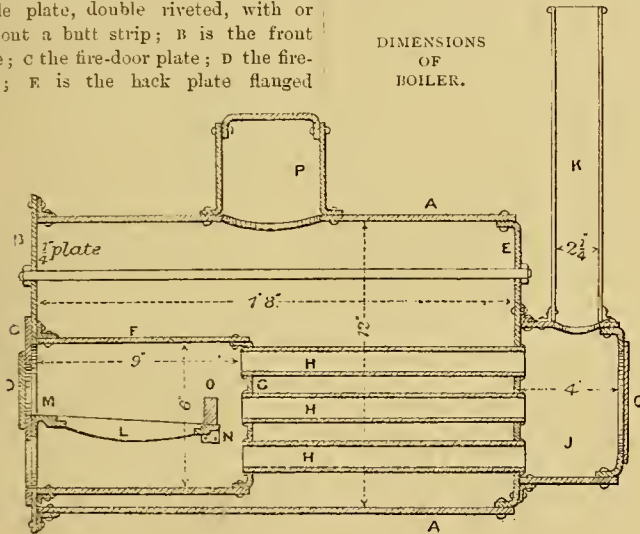
F. R. S. (London).—I would say that he has reason to congratulate himself on the success of his work hitherto, for if he can hear the ticking of a watch through the telephone when in connection with a microphone, he may conclude that his efforts have been in the right direction. The ticking of a watch is a good test and shows him that the principles of construction are correct. Nevertheless, the telephone

course, one goes to earth and the other to line. Give attention to the following: Is the ferrotype plate quite flat and free from any twist, ding, or bruise, and does it lie perfectly smooth in its place? Do the circles in the upper and lower parts of the telephone, between which the plate lies, correspond, and nicely clip the plate? Is the wire good and properly insulated? See that the magnets are carefully regulated; that the wires from coil to terminals are insulated from magnet; that the bobbin fits neatly on the magnet, and the wire evenly wound. Put a Leclanché cell in connection with one telephone, leave one battery wire fixed to one terminal of telephone the other battery wire loose, and with the latter "make and break contact" with the other, the unconnected, terminal of telephone, i.e., keep touching the terminal with the loose wire. A "click" should be heard, adjust till this is at the clearest. Then adjust the other telephone. The magnet should be as near the ferrotype plate as possible, without touching. If touching no sound will be the result, likewise if too far off. Endeavour to get a perfectly quiet place. Be sufficiently apart that the voice cannot be heard, except through the instrument. Have a double line, if possible, as an earth line, say, from the gas, may be in your case defective. Use a musical box at one end and listen at the other. In case of failure to hear sound get a friend to tap with a lead pencil on the diaphragm. If this is heard, and speaking not, most likely the defect is owing to insufficient care in construction or adjustment, or a too thick plate. The difficulty is, I think, merely one requiring patience and experiment. If made according to instructions and care bestowed on work, he must succeed. Shortly, articles will appear on "The Complete Telephone: How to Construct It," including Receiver, Transmitter, Microphone, Bell, Battery, Switches, etc. The main purpose of the articles is to reduce the description and construction of the instrument to the greatest simplicity. They are intended for amateurs possessed of little electrical knowledge and, probably, less cash. Whether F. R. S. is well versed in Electrical Science or not these possibly may be interesting to him and his friends.—J. H. M.

### Bookbinding.

WORKMAN.—The publishers of "Art of Bookbinding" are Messrs. Bell and Sons, York Street, Covent Garden, London.

DIMENSIONS  
OF  
BOILER.



internally; F is the plate for the combustion chamber,  $\frac{1}{8}$  in. thick, attached like the front plate, B, with angle iron. The tube plate, G, is flanged. In this boiler F must be inserted before E is riveted in. H are smoke tubes, of which there may be eight or nine, of about an inch diameter, of 13 or 14 gauge, of copper or iron, beaded over at the ends; J is a smoke-box, whence the products of combustion pass through to the chimney. K. A hinged door, Q, is fitted to the smoke-box, to allow of the tubes being cleaned. The fire bars, L, are of cast iron, resting on a dead plate of cast iron, M, bolted to the plate, C, and on a bearer, N, resting on two short bits of wrought iron bolted to the inside of the combustion chamber. O is a brick arch which deflects the flame upwards before allowing it to pass into the tubes. A man-hole is of no use, but a dome, P, can be added, if it is not too much trouble. You could be sure, then, of getting dry

should transmit distinct speech, but not the ticking of a watch, without the microphone. But how as to the workmanship. Has this been carefully done? Telephones are delicate instruments and require to be carefully made. If F. R. S. can remember, on any occasion while constructing his instrument, being inclined to indulge in some labour-saving process, and mentally exclaiming "Oh, that will do!" he had better look for the defect in that particular part. Careless or rough work will not do, while on the other hand, care in details is amply recompensed. From what F. R. S. says I should judge his difficulty lies in some small detail. The magnets seem to be satisfactory. The heat are made an inch or so longer, but this does not matter. They do not require to lift each other. The connections are simple. Each end of the coil terminates in a terminal to which the two line wires are attached. If an earth wire is used, of



**French Polishing.**

JNO. ROBERTS writes:—"It is rather amusing the manner in which some of your correspondents write on some subjects. Some amateurs write with all the authority of professional workmen, and some professionals write with much depreciation of the efforts of amateurs. Someone some little time ago said that there is no use for amateurs to attempt French polishing as they are certain to spoil the job; that it would be better to rub with beeswax, etc. Now, Mr. Editor, I enclose you a sample of French polishing, and although not up to the finish of a professional polisher, I think you will agree with me that it is very fair and superior to varnish or beeswax. I have tried various kinds of French polish—'Spencer's Instantaneous Polish' included—but could not get the same result in the same time as with this. Indeed, Spencer's is about the worst I have tried. '*Instantaneous*' is a misnomer. I do not believe that adjective will apply to any French polish. As an amateur I have paid some little attention to the matter and have made various experiments with gums in making it with the result which I show you. The following are the gums I have used, viz.,  $\frac{1}{2}$  oz. shellac,  $\frac{1}{2}$  oz. seedlac,  $\frac{1}{4}$  oz. sandarac,  $\frac{1}{4}$  oz. camphor,  $\frac{1}{2}$  pint of spirits of wine. Digest the whole in a stone jar, carefully corked, and immersed for some hours in a saucepan of hot water on the side of the range. It will digest much better and quicker in heat than cold. A disused ink jar will answer the purpose admirably, only be careful that there is not a stain of ink about the jar. By the way, I was not careful in this matter on one occasion, and the ink being blue-black I got green polish. I am quite convinced that any amateur with a little perseverance can master the art or can succeed fairly in it. I never saw a French polisher at work, but have pegged away at it till I have succeeded fairly well. I have made a dressing drawers—four tiers—of the kind of wood enclosed and polished in the same manner, and I can assure you that it looks well. It is not often you see furniture made of chestnut wood, but I gave it a trial as an experiment and am satisfied with the result. I have written the above for the benefit of my brother amateurs, and hope you will favour them with it when you can spare room." [The specimen enclosed is well done, in fact, I have seen much worse polishing than this done by profes-

sionals. It is, however, I fear, a sad truth that amateurs, as a rule, do not succeed in producing high-class work in French polishing, and the fault lies in the fact that they are in too great a hurry to get the job done.—ED.]

**Speed of Dynamo.**

DYNAMO.—Your friend, the electric light engineer, gave you an evasive reply. The speed is not, as he said, regulated by the quantity of iron in the machine. The speed of a dynamo is determined by the required voltage of the current, and the length of copper wire in the armature coils. As a rule, each yard of active wire in the armature coils will develop 1 volt of E.M.F. if given an angular velocity of 1200 feet per minute. If, therefore, we wish to develop a high E.M.F. in the circuit of a machine, we must either wind on its armature several yards of wire, or must drive the armature at a high rate of speed. As, in small machines, there is not enough room on the armature to hold many yards of wire, we must drive the armature at a high rate of speed, from 1500 to 3000 revolutions per minute. In large machines the armatures are large enough to hold many yards of wire, and the coils being wound near the periphery of the armatures, it is not necessary to drive them at a high rate of speed to get the required voltage.—G. E.

**Success with Electric Bells.**

CLERICUS SECUNDUS writes to GEORGE EDWINSON:—"Many thanks, both for your reply in AMATEUR WORK (just to hand) and for your very kind offer to help me, if needful, with my bells. Thanks to the fulness and clearness of your articles, however, I first succeeded (where three amateurs had failed before) in repairing the bells of some friends, and this it was that roused my ambition to have some at home, bells being an unknown luxury in Belgian houses, unless the tenants put them up. Although quite ignorant of anything connected with electric bells previous to reading your articles, I have succeeded in putting them up—including one to ring from below—all of which answer perfectly. I have now resolved to connect my attic workshop with my study on the ground floor by means of telephones. I have connected one wire of my telephones with one wire of the bell system and fastened the other to the gas pipe. As this is not quite satisfactory I shall be really grateful for your help. I take this opportunity of thanking you for the pleasure and profit

I have derived from your articles in AMATEUR WORK, the variety and fullness of which has been a source of wonder to me." [The articles referred to by CLERICUS SECUNDUS were published in AMATEUR WORK, Vol. I., Old Series.]

**INFORMATION SOUGHT.****Observatory Hive.**

J. JOHNSON writes:—"I shall be thankful if anyone will give me information through this Magazine how to make an observatory hive for bees, to take three standard frames the same as used at shows."

**Barrel Organ.**

WOULD-BE ORGAN-GRINDER writes:—"Will someone kindly tell me the mechanism of a barrel organ. I have some wooden pipes and wish to fit them up to play mechanically. I should like to work with a foot-treadle (not the ordinary handle) like some of the mechanical pianos or harmoniums. A rough sketch would greatly help."

**Mechanical Figures.**

A BACK-PARLOUR SHOWMAN writes:—"Can some kind correspondent give me instructions in making some life-size (or nearly so) figures to work by hidden or invisible power. Such as a figure to draw on a board or canvas, Blondin on rope, musical instrument player, or any others. A diagram will greatly assist."

**Musical Glasses.**

MECHANIC writes:—"Will any brother amateur kindly tell me how to make musical glasses from the common drinking-glasses, or where I should find instructions for making same?"

**Glass Blowing.**

HENRY writes:—"Could any of your readers give me a little advice about glass cutting and glass blowing for repairing, such as cutting down a broken decanter or tumbler, blowing feet on wine glasses, etc., and what tools are necessary for commencing?"

**ANSWER DEVOID OF GENERAL INTEREST.**

J. J. PENSEGROW (*South Africa*).—I have passed your inquiry on to The Britannia Co., Colchester, who will quote you a price for the article you want.

**LETTERS RECEIVED UP TO MAR. 13.**

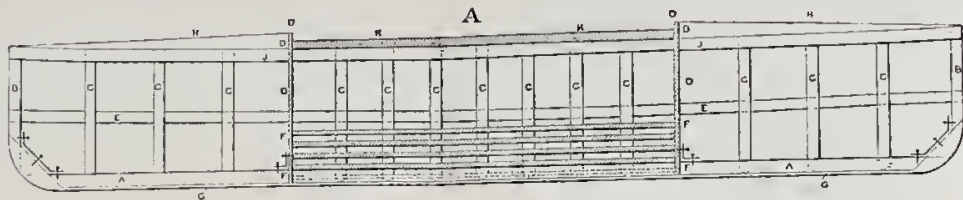
D. W. B. (*Liverpool*); CLERICUS SECUNDUS; PHOTOGRAPH; E. P. BOTT; H. SMITH; M. E.; R. S.; JAMES JOHNSON (*South Africa*); J. D. (*Tierlton*); F. W. LAIDLAW; BOATHOOK; C. A. PHELPS; J. D. (*South Africa*).



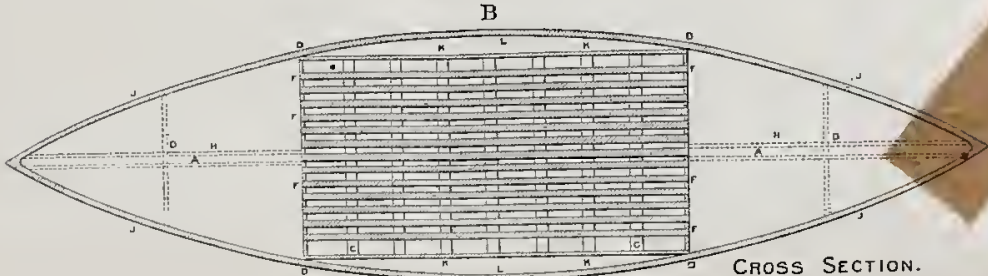
WORKING DRAWINGS  
FOR A  
CANVAS BOAT OR CANOE.

LONGITUDINAL SECTION.

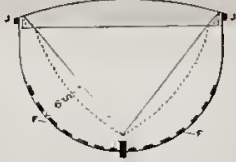
Length 10 ft. breadth 2 ft 6 ins. depth 17 ins. amidships.



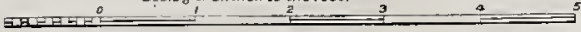
DECK PLAN.



CROSS SECTION.  
C



Scale  $\frac{1}{8}$  of an inch to the foot.



D



Fig. 1.



Fig. 2.



E



Fig. 5.



Fig. 6.

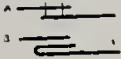
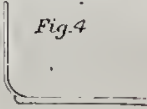


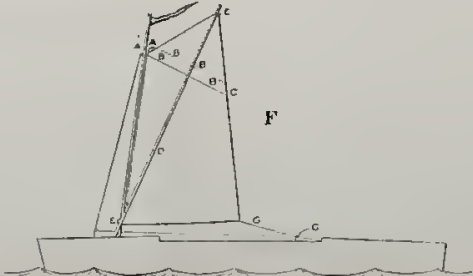
Fig. 3.



Fig. 4.



Scale  $\frac{1}{8}$  inch to the foot.  
Length 10 ft. breadth 2 ft 6 in. depth 1 ft.  
Constructed of Raton, Cane or Hoop.



Scale  $\frac{3}{8}$  of an inch to the foot





1890.

## A NOVEL THERMOMETER.

By FRANK S. MORTON.



FRIEND of the writer, who is of a very curious turn of mind, and who, as engineer of a steam fire-engine, has an abundance of time to develop his ideas,

hundreds, who could hardly believe that so plain an affair could be made to record the temperature. But it will, as many who have watched it will testify. All the materials needed are two strips of paper, a piece of horse-hair, two pieces of wood, and a few tacks. The labour can all be performed with a pocket-knife and a pair

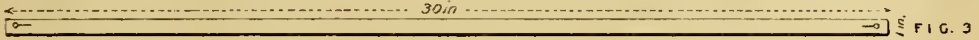


FIG. 3.

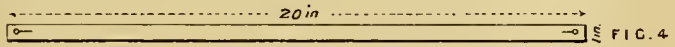


FIG. 4.

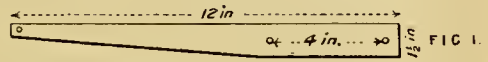


FIG. 1.

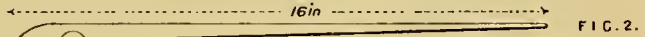


FIG. 2.



FIG. 6.

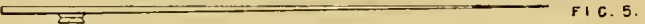


FIG. 5.

FIG. 1. Wooden top piece.

FIG. 2. Hand or Indicator.

FIG. 3. Paper strip for long side.

FIG. 4. Paper strip for short side.

FIG. 5. Edge of indicator showing taper. FIG. 6. Horse hair connection.

FIG. 7.  
The Instrument complete

of scissors. First, take a couple of pieces of wood, and form them as follows: one like Fig. 1, 1 foot long, 1 inch wide, and from  $\frac{1}{4}$  to  $\frac{3}{4}$ ths of an inch thick, the wood to be light. Leave it the full width for 4 inches, and taper the rest down to  $\frac{1}{2}$  inch, as in the Figure. Bore a small hole where the taper commences, and drive a brass-headed furniture tack into each end, letting the head project slightly, say, a sixteenth of an inch.

Now lay this aside, and commence on Fig. 2, or the indicating arm or hand. This should be made in the shape shown, and is 16 inches in length. It may be made of wood, the same thickness as the top piece, and the small pulley at r, Fig. 7, glued on, or a piece an inch or so thick may be used and cut down, making the pulley and hand in one piece. The former way is the easier, and answers the purpose just as well. The piece should

be tapered down nearly to a point at g, and the blunt end may be left the original thickness, only it must be light enough, so that it will not over-balance the pointed end. When on a pivot, at r, the pointed end should drop of its own weight. Then fine away the piece on the side from

has, among the many curious things in his engine-room, a novel thermometer, a description of which, I think, will interest the many readers of AMATEUR WORK. This instrument, if such a combination of simple things can be called an instrument, has been examined by



F to G to a point almost, as in Fig. 5. Glue on the pulley, which should be 1 inch in diameter and  $\frac{1}{2}$  an inch thick, and have a small groove cut in it. Bore a smooth hole, large enough for a wire nail, through the centre and through the hand. Then cut two strips of brown paper, each 1 inch wide, and one 30 and the other 20 inches long. Use straw paper, but if not handily procured, coarse Manilla instead. Cut in the ends of each a "button-hole," large enough to slip over the brass-headed tacks in the top piece. A piece of coarse hair from a horse's tail should next be procured, and divided into three pieces, which should be twisted together, and a loop tied at one end around a small piece of wire, and around a carpet tack at the other. The pieces should be about 6 inches in length.

Now select the spot on the wall where you wish your thermometer to be placed, and proceed to put it together. It will require a space 16 inches wide and 3 feet high, if made by the measurements given; but, of course, it may be made larger or smaller, as one chooses. Tack up the top wood piece, Fig. 1, putting the nail through at B, Fig. 7. Use a round, smooth nail, so that the wood will work freely on it. Button on the strips of paper, the long piece at the left and the short piece at the right of the nail. Let them hang perfectly perpendicular, and with the top piece as level as possible, drive a tack through the end of the short piece, at A, into the wall. Loop the horse-hair end, which has the piece of wire tied on it, through the lower hole in the long strip at E. Hold the lower wooden piece or hand up against the wall, and bring the lower end of the hair round on the underside of the pulley, and fasten these with the tack, letting the hair run in the groove. Now bring the hand so that, with everything straightened out, the right side of the pulley is directly under the tack at D, and fasten it to the wall by a long wire nail, through the hole in the centre of the pulley.

Now all that remains is to arrange the scale under the point of the hand, and the instrument is complete. Cold weather will contract the paper and horse-hair, and the hand will move

up. When it becomes warm they will expand, and the hand will drop down.

It will now be seen how necessary to its good working is the preparation of the holes in the wooden strips, and the driving of the nails for them to work on. They must be made to work free and easy, and then the slightest changes of temperature will affect the hand. The varying qualities of paper make it impossible to give any correct idea as to how the scale should be divided off; but the best way is to borrow a thermometer and hang it by the side of your home-made one, and record the changes by it. When the mercury goes up or down one degree, mark the distance travelled by the hand, and so on for different temperatures. In a short time your scale will be complete.

Besides having a fairly-accurate thermometer, you will have quite a curiosity, as few people will believe, at first, that the contracting and expanding powers of horse-hair and paper are so great.

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## THE MYSTERY OF STATIONERY FORWARDING:

### ACCOUNT-BOOK BINDING.

By ALFRED BEAN.

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II.—MARBLING.

**I**N bringing before my readers an account of the operations incidental to that mode of embellishing the edges and environs of a book designated marbling; they will, I hope, be pleased to excuse me from giving any explanation as to the origin of the name appropriated by this art, the aptness of which name may be judged by each amateur for himself. For my own part, dissimilar as some of the colour designs at any rate are from their alleged original, I still think that much may be said, both sentimentally and practically, for the variation; though, from the best motives, I refrain from occupying your no doubt valuable time with the recital of these arguments. Should, however, this supposed improvement on the work of nature be unacceptable to any of the

students of AMATEUR WORK, the opportunity offers for them to discover some means by which a more exact reproduction of the beauties of marble may be placed about the modern volume. To these the following hints may, perhaps, be of some use in giving them a starting place, from which they may proceed to the invention of the new decoration; whilst they will also, I hope, be found to contain matter beneficial to the worker, satisfied, at least for the present, with the orthodox style of ornament.

The operation of marbling, as usually performed, consists in floating on the surface of a solution of gum tragacanth a suitable selection of colours, which are then spread, combed, or waved, to suit the fancy of, or instructions given to, the marbler. A sheet of paper or the edge of a book is then placed on this buoyant colour, which thereupon immediately transfers itself to the new arrival. The object aimed at by the marbler must be an appropriate distribution of the colours, combined with their proper selection and harmonization.

Before entering more fully into the subject it will, perhaps, be as well to give you some information as to the preparation of the necessary apparatus and material; the foremost portion of the former being the trough for the reception of the colouring-bearing size. This may easily be made at home, being, in fact, merely a wooden box, measuring 22 inches by 9 inches, and having a depth of 3 inches. The inside edges of this trough should be bevelled down to about half an inch, whilst the joints, of course, should be made perfectly water-tight. The next item is a whisk of some kind for the beating up of the size—perhaps for this an old household eggbeater may be appropriated. Other needful properties consist of “combs,” the method of making which will be described; an ordinary slab, and muller, for the grinding of the colours, five small pots for the reception of the same, after their preparation; the same number of finger sprinkling brushes, which may also be made in the home-factory, and half-a-dozen penholders or similar round pieces of stick, one of which should be pointed at the end.

The gum tragacanth, one and a-half ounces

of which should suffice for the marbling of, at least, fifty ordinary books, must be of the best, as must also the colours, the most useful of these being the following: Drop lake, deep orange chrome, indigo, green, black.

To prepare the size, place the gum, with just sufficient water to cover it, in a large jar, where it should remain for at least a dozen hours, at the expiration of which time a little more water should be added, the whole being then well beaten up with the whisk. The operation of adding water and beating up must be repeated at intervals of a few hours, until enough of the solution is obtained to nearly fill the trough, into which it must afterwards be strained.

The colours, in the preparation of which all your patience will be required, should be ground and re-ground, using rain-water or beer as a medium, until no sign of roughness whatever can be distinguished. After their thorough reduction place them in the cups, and add a little spirits of wine, with a single drop of ox-gall, stirring the whole well together; then, to test their condition, take up a little of each colour in turn with one of the penholders (using a separate one for each tint), which draw across the size, without, however, immersing the stick below the surface. As soon as the colours touch the gum they should spread themselves out to a width of about an inch. If they do not do this, add another drop of ox-gall, and try again. This streak will also show you the manner in which you have ground the colour; if not rubbed sufficiently, the grains will show quite distinctly on the surface of the size. To remove the unused colour from the gum, take a strip of paper 11 inches by 1 inch, and insert it into the size across one end of the trough, the ends being pressed to the sides. It must then be raked across the size to near the opposite end, after which another and another strip must be drawn along until the surface is quite clear of colour for the greater part of the length of the trough.

In the manufacture of the combs we shall require a few yards of brass wire, about the thickness of a small darning needle, and about the same amount of the diameter of a fine sewing



needle. Half-a-dozen pieces of  $\frac{1}{4}$  inch wood, measuring 8 in. by 2 in., with one of the long edges of each chamfered off, will also be wanted. At three-fourths of an inch from the chamfered edge—but on the opposite side—of three of these a line must be drawn. Mark along the line on one of these, distances of one-third of an inch, and along the two others intervals of about three-sixteenths of an inch, and three-thirty-seconds of an inch respectively. Commencing now at the edge of each of these three pieces and, proceeding at right angles to it, cut slight notches, ending at the marks on the three-quarter inch line. The wire, cut into 2 inch lengths, may then be placed in these niches, after first, however, covering the wood with thick glue. The fine wire should be used for the piece measured with the narrowest distances, the other two boards being provided with the coarser gauge. After this installation, cover each row of wires with one of the remaining unnotched pieces, and place under a weight until dry, during which time you may be preparing the brushes. These are very easily made, being merely small pieces of wood—penholders, again, would do—surrounded at one end by a few stiff bristles, and covered at the solid portion with a wrapping of string, which is afterwards impregnated with strong glue.

A word, however, on the best method of wrapping these and other brushes may not here be out of place, seeing the facility with which some string-covered tools seem to doff that covering. To properly adjust or renew the garment then, commence by tying one end of its constituent, the string, to a firm support, a door handle say, laying the other extremity over the bristles, where it must be held until covered by the first turn or two of the cord. Now retire from the support as far as the string will permit, and turn the tool evenly round and round, pulling hard the whole time, until the required section is sufficiently clothed, when the string may be secured and be given its overcoat of glue.

It is now time to examine the process itself, for which so much preparation has been necessary. We will take the simplest pattern first, viz., Large Dutch, which, although only used for the largest size of books, will form a good first exer-

cise. For this marble we shall need the four colours, red, orange, green and blue. First, draw the stick holding orange colour half-a-dozen times across the size at equal distances, following it with the blue streak against each position of the orange. The green must now take a place between each blue and following orange streak, the red being then drawn between the blue and green, and also betwixt the latter colour and the orange. Now take the widest intervalled comb, and lightly draw it along the surface of the trough. This should cause the colour to form a number of elongated crescents, the points being drawn along by the teeth of the comb, whilst the central portions keep as it were (excuse the Hibernianism) in the rear. Immediately after you have obtained a satisfactory marble, take the book, which should be in readiness, sandwiched between two stout millboards, and apply the edge to the combed colour. To do this properly, hold the book in an inclined position over the trough, then gradually depress it until the lowermost end touches the size, when it should be steadily brought to the level. The volume is then at once removed and the edge cleared of the adhering size. For this purpose, take the book with its concomitants, the boards, to a suitable trough, on the edge of which it must be tightly pressed by means of the left hand, whilst water is thrown upon the dipped edge from a vessel held by the right. Then, after wiping as much of the moisture as possible from the sides, but not the edges, of the volume, it may be laid on one side to dry. It should be borne in mind that the foregoing operations must follow each other as quickly as possible to form a perfect edge. You must also remember that before laying on the size any more colour, care must be taken to clear the remaining portion of the last pattern from off the workable part of the trough, by means of strips of paper, as before described.

The above Large Dutch pattern is sometimes varied, by drawing the combed colours up or down in one or two places by means of the pointed stick.

For a lesser book a rather different method is pursued, forming a marble entitled Small



Dutch. The streaks in this case, whilst taking the same order as in the first design, are drawn along, instead of across, the trough; thus admitting of only two lines of each of the three first colours, the lake dividing them, as in the Large Dutch. The pointed stick must then be used to alter the direction of the streaks. To do this, commence at the extreme left of the trough and trace the point lightly across the lines of colour, returning it at a distance of about a quarter of an inch from the first stroke. Repeat this as quickly as possible, and as many times as the length of book will require, taking care at each turning point to make a small circle in order to prevent the colour being left against the edges of the trough, where it would, of course, be useless. This journey of the stick you will see multiplies considerably the original number of streaks, whilst, however, still retaining them in proper order. In this condition the marble takes the name of the Zebra, which animal, by the way, is perhaps as frequently seen as the volume adorned with the marble named after it. To transform this Zebra into Small Dutch, the intermediate comb must be employed, as described for the larger pattern.

The only other design for which a comb is required is termed Nonpareil, and is, as a rule, placed on the edges of the smallest stationery only. For this marble you will need the whole five colours with which you are provided. They should be used rather thinner than in the preceding examples, it being necessary to sprinkle them upon the size in this instance with the brushes. In putting on the colours, knock the bristles of the brush, after being dipped in the cups, against a finger or small stick held near the trough for that purpose. The black should be first deposited, then the others in order as before, distributing them as evenly as possible about the trough, at the same time, however, giving a preference to the drop lake. The pointed stick must then again be brought into service, in order to transform these blotches into a row of lines, the colours being finally drawn with the narrowest spaced comb.

The above are all the marbles usually used in stationery work; but, perhaps, whilst on the

subject, I may be allowed to briefly describe some of the more difficult processes which are employed in marbling the library volume, the most common of these marbles being termed Spanish.

As I have said, the letter-press patterns require much more skill than their sisters of the account-book, a little more experience being necessary in the correct mixing of the colours, and also in their proper distribution. Most of you, however, have, I believe, attacked and conquered subjects as difficult even as letter-press marbling, therefore I will waste no time in scaring you, as it were, from the art, but will proceed to the more pleasant task of helping you to obtain through it another success.

If you will look, then, at a sheet of Spanish marble paper, you will, perhaps, notice, traversing the paper in all directions, a number of streams of colour, which streams encircle larger patches of another shade, the which a geographical marbler might term islands. On further examination this network of streams will be found to consist of two or more lines of colour, technically called veins, the finest of these, most probably, being found, on the sheet under scrutiny, to be black. The adjoining colours will most likely be red and yellow, or, perhaps, only one of the two. The body colour, which we have been considering as an island, may be of any shade.

In imitating this marble the size must be made rather weaker than that used with the combs, the colours, also, being reduced. These latter, too, must be provided with gall apportioned to the position they are intended to take in the finished design, as will in a few lines be shown. The black should be sprinkled on first, the very smallest quantity being used. It must also be put on in the finest drops, and should be distributed evenly throughout the surface of the size. Barely any gall is necessary, both in this and in the two following colours, red and yellow. After these are satisfactorily deposited in rather larger quantity than the black, sprinkle on the size in the same manner a little water containing a small quantity of gall. Now shower on the required shade of body-colour, in sufficient quantity to

drive the preceding colours into veins, for which purpose it will need, of course, rather more gall than was necessary in those first colours.

Having produced a creditable Spanish copy, a slight variation may be made in the next exercise, by grinding with the last vein-colour a very little oil. As this makes the vein hold out very much more against the progress of the final body-colour, this latter must be furnished with an additional quantity of gall, to enable it to overcome that resistance. For the purposes of this marble, which is named Shellveined, linseed oil is used, prepared as follows: Having obtained the best raw material, soak with it a clean linen rag, which must then be taken to some place free from danger and be there set on fire. The burning drops are then caught in a basin, and placed in a bottle for use. I had almost forgot to mention that on the completion of the book or batch of books under treatment, the size should be strained from the residual colour, and be kept in a covered vessel till again required.

In concluding my description of marbling proper, I would remind you that this art is essentially one for example rather than precept. If you cannot obtain a glimpse of a marbler at work, you may, at any rate, study well all the results of his skill which may come under your notice—I mean, in the shape of marbled paper or book-edges—and there you will find, I think, much food for reflection.

For the use of those not having perseverance enough to carry out the legitimate process I append a method of transferring the colour from paper already marbled. For this purpose the unglazed paper should be obtained, if possible; you will, I think, be able to procure it, along with the other material, at Messrs. Berry and Roberts'. A little spirits of salt will also be required, together with some scrapings of zinc, a pad of soft paper a  $\frac{1}{4}$  inch thick and the size of the edge to be adorned, and, finally, an—onion!

The book should be screwed tightly in the press, the cut edge flush with the accompanying cutting boards, in which position it must be scraped perfectly smooth. Now pour out some

of the spirits of salt into a saucer, and drop into the liquor some of the zinc scrapings. As soon as these are dissolved, soak in the product a strip of marble paper the size of the edge to be coloured, then, after rubbing this edge with a slice from the onion, cover with the saturated paper, placing over it a strip of blotting and the pad of soft paper. Now hammer this cushion smartly at every portion of its surface, after which, on removing the paper, a fair copy of the original should be seen on the edge of the book, not equalling the best contributions from the trough, of course, but still, perhaps, excelling in appearance many of the designs obtained through that medium.

## HOW I FITTED UP MY DRILLING APPARATUS.

By CLERICUS SECUNDUS.



HERE is an accusation in Vol. II. of AMATEUR WORK, Old Series, which it is to be hoped many amateurs have laid to heart. Saith the Rev. Jas. Lukin (page 349): "It is astonishing how few amateur workshops contain efficient drilling apparatus." These words had lain heavily on my conscience (*qua* amateur) ever since I read them, for in my "amateur workshop" there was no "drilling apparatus" at all.

True, I had excuses, plenty of them, for that is a crop which never fails: Firstly, there were the exigencies of time. I was only a beginner in the craft, and, as the Editor has constantly to remind impatient subscribers, "everything can't be first."

Secondly, there were the exigencies of space. I had contrived to crowd my bench and lathe into the only room then available (a small lean-to affair of the kind known to continental architects as "*une annexe*"), but any more apparatus was out of the question. As it was, it was fortunate that, like Mr. Dick, of happy memory, "I did not want to swing a cat, and never did swing cats," for had I made the attempt, it would have been awkward for me—likewise for the cat.



But being called upon to "flit," it came to pass that I found myself and the belongings aforementioned promoted to what might be called the attic, but which in view of size and former destination is denominated "the studio."

Here was room enough, at all events, and I straightway considered it due to my now exalted station to wipe away the reproach which lay at the door of my workshop.

I also concluded that I could hardly do better than follow the good advice given in the said article, but, in working out the details, was led to make some slight alterations, and having learned a thing or two (and paid for them), I should like, if the Editor thinks them worth a place in his columns, to give my experiences *pro bono publico*, in the hope that others may be stimulated to go and do likewise.

My first care was the bench. I had some quarterings, 3 feet long (which in the larger garden of my former residence had done duty as part of a poultry-house, and which had since figured as the legs of stalls at a bazaar), and five of these, nicely planed up, were told off for the legs.

I fear I shall incur the contempt of all skilled amateurs, not to speak of any chance "professional" reader, when I confess I did not spend my time over mortise and tenon joints. But a variety of reasons—facility in the matter of taking to pieces not being the least—made me settle upon another and simpler plan.

Having decided that the bench top should be 4 feet long, I took two lengths of  $\frac{3}{4}$  inch planking, 3 feet 8 inches long, and screwed them to the top of the legs back and front. Two lengths of similar planking, 23 inches long, did like duty at the sides, and completed the framework. Placing this against the wall, I screwed each leg firmly to the floor, by means of L-shaped pieces of iron, drove two long hooked nails (they call them *crampons* abroad, I don't know the English name, see Fig. 3, *v*) into the wall to fix the hind legs, and my frame was fixed and steady.

Next came the bench top. I had nothing but  $1\frac{1}{2}$  inch deal by me, and as financial reasons forbade unnecessary outlay, it was decided in solemn

conclave between me and myself that, although a harder wood would evidently be preferable, my deal planks must do. Taking three pieces 4 feet long by 9 inches wide, I shot the edges, jointed them up to the best of my ability, and planed the top smooth. I was about to fix this to the top of my frame when a new idea occurred to me. I measured the inner opening of my frame, *i.e.*, that left by the  $\frac{3}{4}$  inch planks which held the legs together, and found it to be 3 feet 8 inches by  $16\frac{1}{2}$  inches. Then, turning the bench top face downwards, I marked on the reverse side a quadrangle the exact size. I happened to have by me a number of plank ends (more poultry-house-bazaar remains), so, cutting them to exactly  $16\frac{1}{2}$  inches, I proceeded to fill up my rectangle, screwing them on at right angles to the planks forming the top. By this means I not only increased the thickness of my bench top, but strengthened the joints (in which I lacked absolute confidence) and also obviated (I trust) any future tendency to warping on the part of my 9 inch planks. Moreover, the rebate formed by the edges of my  $\frac{3}{4}$  inch planks just fitted into the opening of the frame below, and would almost have sufficed to keep the top firm. See Fig. 2. However, by screwing it on to the frame all round, I committed a fresh offence against the ethics of joinery (for which I crave forgiveness from the critical reader) and obtained a bench as firm and steady as (let us say) the squares of British infantry at the battle of Waterloo—of which Napoleon is *reported* to have said, "It is not enough to kill the men, you have still to knock them over after they are dead."

My next step was to invest in the gas fixtures needed for the apparatus proper. I decided that the vertical bar should be of  $1\frac{1}{2}$  inch tube, and 4 feet long. The bench being against the wall, the socket with a nut screwed on behind to clamp it to the partition (?), as shown in Mr. Lunkin's sketch, was not practicable. So I purchased a 4 inch flange to screw against the wall, and an elbow joint to screw on to the vertical bar. Both flange and elbow were provided with female screw-threads, but we parried that difficulty by means of what the merchant called "*un nippelle*,"



*i.e.*, a short end of tube screwed the whole length, and fitting into both elbow and flange. See Fig. 3, c, d, e, and f. When I came to the arm which was to carry the "pressure screw" (as they call it here), a difficulty presented itself. Mr. Lukin shows the drill-socket of his brace immediately above the almost-closed jaws of his vice, but as, according to his arrangement, the drill can only work at some point in the segment of a circle of which the length of the arm is the unvarying radius, I fail to see what would happen, if it were necessary to drill a hole at any point within or beyond this radius. To meet this difficulty, I procured two lengths of tubing, one of which just slid stiffly into the other. Necessarily, the T-pieces were no longer of similar size, as in Mr. Lukin's sketch, as one had to be screwed on the end of each tube. See Fig. 4. A binding screw in the T-piece, which slides over the vertical bar, and another in the end of the arm to fix the sliding tube, made these parts as firm as could be desired. As I happened to have a spare cross-key, I had the binding screws made with a square head to fit the key.

By way of "pressure screw," I got the gas people to run a thread along 6 inches of tubing to fit the T-piece at the end of the arm, the thread in the T-piece being continued right through. Then, instead of a round head with a hole through it (*vide* Mr. Lukin), I procured a diminishing T-piece (I know nothing of the technical terms) and passed a short bar of iron into the cross-piece at the top.

I purchased the hand-brace ready made. It has an advantage over the simple forged one sketched by Mr. Lukin, in that there is a piece of brass tube at the point grasped by the hand, and in which the brace revolves. This will be appreciated by those who do not work a hand-brace every day. My brace does not carry a point on the upper arm, but ends in a solid boss (?), with a slight cone sunk in the centre; so I got a piece of steel roughly forged to shape, fixed its shank into one end of the "pressure screw," and the diminishing T-piece on the other, and mounting the whole between the centres of my lathe, turned an "illigant" point on the end of

my piece of steel. I am inclined to be rather proud of the latter achievement, as it is my first attempt at metal-turning. By the way, one or two tools came to grief in the process, but that is a secret only to be whispered into the sympathetic ears of those who can pity the sorrows of a "poor amateur" (in a double sense).

Then came the fitting together. I had intended fastening a square of plank to the wall to take the flange at the top of the vertical bar, but on examination, decided it would not be firm enough, so I got a plank 8 feet long, 6 inches wide, and  $1\frac{1}{4}$  inches thick, to stand on the floor against the wall behind the bench. I had to cut a space out of the edge of the bench top, 6 inches by  $1\frac{1}{4}$  inches, to slide the plank through. This was soon done, as I had a chisel that cut into the wood splendidly (likewise into my thumb), and by screwing the bottom of the plank into the skirting, "jamming" bench against its middle, and driving sundry clamping nails (Fig. 3, b) at the top and sides, I made sure of its not displaying any eccentricities at the wrong moment.

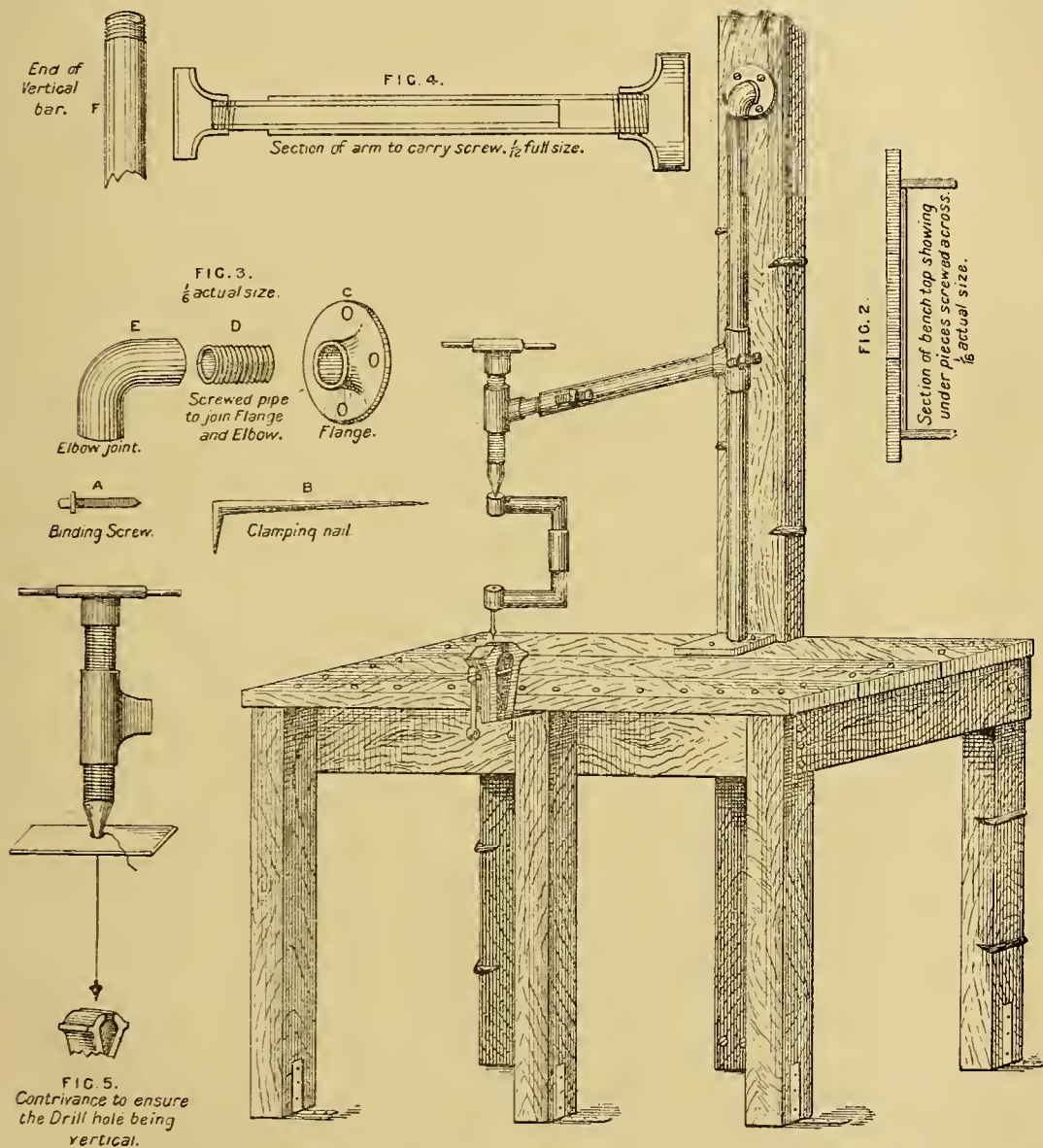
Mr. Lukin cut a hole into the bench top to take the bottom of the vertical bar, but I preferred cutting a small square of plank, and fixing the bottom of the bar into that. The advantage is, that by fixing the flange at the top with one screw (temporarily) I could move the bottom about whilst I plied the plumb-line until I was sure that my vertical bar was thoroughly worthy of its name. Then a couple of nails in the plank to fix it to the bench top, and the remaining screws in the flange, fixed it.

The remainder of the fitting does not differ from Mr. Lukin's, and can be gathered from Fig. 1. The fifth leg is meant to support the leg of the vice, which is to be bought when—well! some day. Meanwhile, a table-vice does duty, and the upshot is, that for a very moderate cost, I have an apparatus whose "boring" capacities equal those of any man I know—which is saying a good deal.

For rough work, a little of "wobble" on the part of the hand-brace does not much matter; but there may be occasions when accurate work is necessary, and it is always well, perhaps, to

be as accurate as possible. In that case, the point of the "pressure screw" should always be directly perpendicular to the point where the hole is to be drilled, and a hint how to ensure

hole nearly through, to fit the point of the "pressure screw," make a pin hole through the remainder of the thickness, and with the point of the blade of a pocket-knife, make a minute



this may not be unwelcome to some of my readers.

Take a strip of hard wood—mahogany will do nicely—say,  $\frac{1}{2}$  inch thick, and countersink a

channel up the side of the cone, just to take a fairly stout thread. Then take a piece of thread, fasten one end to a small lead (mine cost one penny at a toy-shop), pass the other end upward

through the pin-hole, and lay it in the prepared channel. Now hold the cone in the strip to the point of the screw and work the arm round and about until the point of the lead is just over the selected spot. See Fig. 5. By keeping the drill well to its work the brace will revolve "true," and the hole drilled be accurately vertical.

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## HOW TO "MAKE UP" FOR THE STAGE.

By PROFESSOR LIONEL ARTHUR.

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I.—"MAKING UP," WHAT IS IT?—ESSENTIALS TO SUCCESS—MATERIALS AND TOOLS—COMPLETE OUTFITS.



HAVING promised my friend the Editor of this popular Magazine some practical papers on the "Art of 'Making Up' the Face," I now hasten to redeem my pledge, and trust the perusal of the instructions will give my readers as much pleasure as it will me to write them.

That articles on this special subject will be widely read I have no doubt, as the extraordinary popularity of amateur theatricals at the present day will amply testify; my only fear is, that I may not be sufficiently qualified to treat the subject in that clear and practical way which is such a necessary adjunct to successful technical writing. However, I will try, and should I succeed in delighting my readers in even the slightest degree, I shall consider my labours well rewarded and rest contented.

We had, first, better set ourselves to consider what the art of "making up" the face really is, and its *raison de être*, and then we may afterwards proceed to experiment on the various methods employed in this interesting work of the stage, fascinating to many, from the mere fact that the transformation takes place by—to the lay mind—unknown means within the secret precincts of the dressing-room, where none but the initiated are ever allowed to tread.

To come, then, at once, to the point: "making up" is simply the art of adapting or altering the features of the face and the appearance of the hands and arms, by aid of colours and other materials, in such a way as to make

them conform to the requirements of any character the actor is called upon to represent. The explanation of the term is very simple, not so, however, is the art itself in practice, for this requires some degree of skill and taste upon the part of the artist, combined with much forethought, and, above all, a careful study of character in general. There are, I know, a great many amateur actors who prefer to employ a professional perruquier to make up their faces and adjust wigs, whiskers and moustaches in a natural and lifelike way, and I have nothing to say against this practice—*when it can be afforded*. Still, this means expense, especially if a long railway journey and hotel expenses have to be added to the artist's usual fee. For this very reason, therefore, the services of the professional perruquier have more often than not to be dispensed with, and with the very frequent result of the audience being immensely tickled at the awful frights some of the would-be Irvings make of themselves in their attempts to realize an original and elaborate "make up."

There is, of course, no possible excuse for these failures in "making up," because it plainly shows that the actor has completely neglected this important feature in his performance until the last minute, instead of rehearsing it, with just as much pains, as he has the play itself. Carelessness, too, and ignorance of the art of the stage, has much to answer for in this direction, for what looks more abominable than an ill-fitting wig, too short at the back and exhibiting with every turn of the actor a great tuft of his natural hair, and, perhaps, a piece more on each side of his forehead. This, and many other defects incidental to the amateur stage, are easily remedied and avoided, and it will be my purpose in future chapters to point them out and show how they may be rectified and improved upon.

There is a general impression with amateurs that "making up" is much too difficult an attainment for them to handle successfully. Now this is hardly so, especially if the student is schooled in the correct way. I must admit that a great deal more care as regards their general make up is required of amateur than of



professional actors, since the former generally play much nearer the audience—usually in small halls—and must, therefore, avoid making their lines too harsh, in fact, they must soften and tone them down. Again, the amateur actor may have many personal friends in the audience, and he works under a great disadvantage, for unless he is well made up and partially disguised, he is instantly recognized as his own individual self, instead of the character he hopes to portray, and so all attempt at illusion is hopelessly frustrated at once and for good. But even with this and other drawbacks, I beg to maintain that the amateur may soon attain a creditable degree of perfection, if he is properly instructed, and follows those instructions to the letter, and devotes a good amount of time to practice before the looking-glass in the privacy of his own room. There is, however, one great essential to success in the art of "making up," and that is the aptitude or gift on the part of the artist for studying character in public life, from the highest to the lowest of human mortals, and to be an adept in this particular it is necessary to be a constant and keen observer of human nature in all its phases, good, bad, and indifferent. I should much like to lay before my readers other aspects and considerations of the why and wherefore of this subject, but the space at my command is so exceedingly limited that I have already overstepped the space I intended to allot to these few introductory observations, and must, therefore, at once proceed to the practical portion of our subject.

*The Perruquier's Outfit.*—No workman can execute a job without tools, so I will commence by advising the reader as to what to purchase and what to avoid in the shape of material, tools, and other necessities, suffice it to say that we can do just as good work with a few of the most simple and inexpensive articles, as we could with the most costly outfit—provided we have the talent and necessary knowledge—as the latter may be looked upon as a luxury, purchased and used "just for the look of the thing." It may interest amateurs to know that an old cigar-box is the usual receptacle for the professional actor's making up "kit," and, I need hardly say,

that nothing could be handier. Of course, it is very nice to have a polished chest, either of tin or wood, and fitted up internally in the most convenient form. I shall presently describe this article, as sold at the shops, but a great many amateurs can, no doubt, manufacture their own box at home, made to contain just those articles they fancy, and thus avoid having to put up with things they really do not want nor are likely to require. The articles for fitting up the home-made box can all be purchased separately. We will first take the materials required for "making up" and their cost.

*Antimony.*—This is purchased in powder and is used by many for shading the hollows of the eyes (1s.)

*Blue Powder.*—For giving an unshaven appearance to the chin, etc. (3d.)

*Burnt Umber.*—For lining purposes (2d.)

*Beauty Spots.*—Per packet (6d.)

*Carmine.*—To be used sparingly (6d.)

*Chalk, Prepared.*—White and pink, for clowns, statues, etc. (4d. per lb.)

*Chrome Yellow.*—To lighten the hair, whiskers, etc. (6d.)

*Cold Cream.*—This has many uses.

*Cocoa Butter.*—Excellent for removing "make up" from the face (large stick, 1s.)

*Cosmetique.*—White, black, or brown (3d.)

*Crépe Hair.*—In every possible shade and colour, for making false whiskers, moustaches, etc. (6d. per yard all colours).

*Dutch Pink.*—A yellow pigment, used to represent sallow complexions, death, etc. (6d.)

*Email Noir.*—Very handy for "stopping out" teeth in old men's parts (6d.)

*Face Powder.*—Used principally by ladies, C. H. Fox's Special (3s. 6d.)

*Grease Paints.*—These are the most important articles used in "making up." I will merely give a list of colours here, their uses being more fully explained later. The German Grease Paints, manufactured by L. Leichner, of Berlin, are mostly used by the theatrical profession, and they are said by the wholesale agents in this country to be made of chemically pure fat and purified colours *free from lead*. C. H. Fox, also, makes a good brand, but I do not know whether

he guarantees their purity. I would, however, advise my readers to use the chrome yellow colours as sparingly as possible upon the skin, as I cannot see how these can be free from lead, etc.

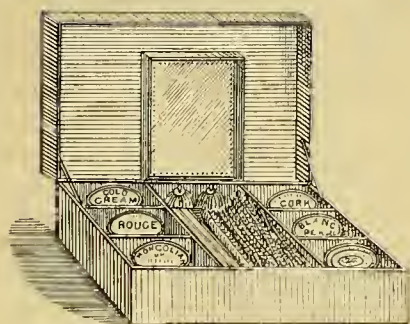


FIG. 1.—CLOTH COVERED "MAKE UP" BOX.

Leichner's paints are at present made in thirty-three different shades, as follows :—

- |                              |                              |
|------------------------------|------------------------------|
| 1. Flesh, Ladies' Complexion | 13. Mulatto.                 |
| 1½. " " "                    | 14. Zouave.                  |
| 2. " Young Man, 18 to 24     | 15. East Indian.             |
| 2½. " " " 25 to 30           | 16. Gipsy.                   |
| 3. " Man " 31 to 36          | 17. Vermillion.              |
| 3½. Strong Flesh Colour.     | 18. Carmine, pure.           |
| 4. Sailor or Soldier.        | 19. Old Red (for lines).     |
| 4½. " " " Darker.            | 20. White.                   |
| 5. Dutchman.                 | 21. Blue Grey.               |
| 5½. Japanese.                | 22. Lead Grey (for shading). |
| 6. Old Man.                  | 23. Yellow.                  |
| 7. African.                  | 24. Deep Orange.             |
| 8. Chinaman or Japanese.     | 25. Brown (for lines).       |
| 9. Red Indian.               | 26. Dark Blue (for veins).   |
| 10. Egyptian.                | F. Olive Colour.             |
| 11. Othello.                 | K. " " Darker.               |
| 12. Nigger.                  |                              |

ALL COLOURS 6d. PER STICK.

Nos. 18 to 26 can be had in long thin sticks for lining purposes. Small lining pencils at 4d. per stick, in following colours : black, brown blonde, pale blue, green, blue, dark red. Eight grease paints, all useful colours, may be had in a neat cardboard box for 2s. 6d.

Mr. Albert Homburg, 8, *Briggate, Leeds*, sells, in porcelain pots, a special grease paint for ladies. This is of a much softer consistency than that in the sticks. It is made in seven shades, one white, three pink, and three cream (1s. each).

*Indian Ink*.—For lining (2d.) *Indian Red*.—For Indians, etc., etc., from any colourman's.

*Joining Paste*.—A thick stick of flesh-colour grease paint for rubbing on forehead, to make the joint of bald wigs invisible (6d. and 1s.) *Paste Powder*.—For enlarging and deforming nose and cheeks (1s. per box). *Paste, German*.—An improvement on the former article (1s. per stick). *Pink Wool*.—This is also used for same purpose (3d.) *Patches*.—For the face, to be used in powder costume parts (6d. per box). *Prepared Fullers' Earth*.—For powdering skin before "making up" (6d.) *Rouge*.—For rouging the face, etc. (6d. and 1s. per box). *Ruddy Rouge*.—For sunburnt complexions (6d.) *Spirit Gun*.—For affixing whiskers, moustaches, and eyebrows to face (6d.) *Vaseline*.—For removing "make up," etc. (6d.) *Violet Powder*.—For laying foundation of "make up," and softening or toning down the same when completed.

Certain tools are required for applying these preparations to the face, etc., and the following are sold for this purpose: Brushes, Camel-hair.—For lining the face with water colours, etc. Wig Blocks.—For dressing wigs upon (3s. and 7s. 6d.) Hares' feet. — For applying rouge

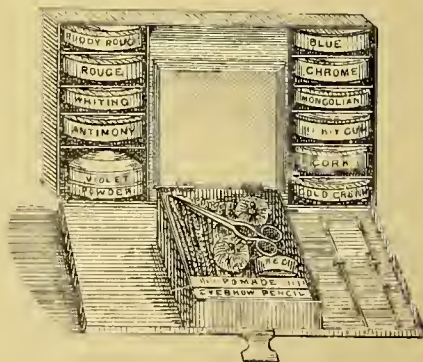


FIG. 2.—JAPANNED TIN "MAKE UP" CASE FOR TRAVELLING

(common, 3d. and 6d.; with ivory handle, etc., 1s.) Curling irons (6d.) Spirit-lamp (1s.) Sponge (1s.) Powder-puffs (6d.) Paint-saucer, gum brush, looking-glass, towels, scissors, needle and cotton, pins, etc. etc.

I have now given a pretty full list of the articles used in "making up," but I need hardly say there are many more mentioned in the wig makers' catalogues. But these are mainly preparations for the ladies, and even with the

articles I have enumerated, it is entirely optional whether the artist has them or not in a great many instances. In my next chapter I will give a selection, so that the amateur may start upon the smallest possible and least expensive scale.

There are, no doubt, some amateurs of the wealthy class who prefer to purchase a "make up" outfit complete, and these may be had, as shown in Fig. 1, for 15s., completely fitted, in a cloth board box; or for 21s., in a portable tin travelling case, Fig. 2. These boxes contain the following articles, viz.:—Rouge, pearl powder, whiting, Mongolian, ruddy rouge, powdered antimony, joining paste, violet powder, puff and box, ceruse, blue, burnt cork, pencil for the eyelids, spirit gum, Indian ink, burnt umber, camel-hair brushes, hares' feet, wool, crêpe hair, cold cream, paint saucer, miniature puff, scissors, and looking-glass. Carriage per parcel post, 1s. extra. I may add, for the convenience of my readers, that these boxes, as well as any other "make up" articles, may be had of C. H. Fox, *Russell Street, Covent Garden, W.C.*, or of Albert Homburg, Wig Maker, 8, *Briggate, Leeds*, both of whom issue catalogues. In the next chapter I shall describe and illustrate the various kinds of wigs used upon the theatrical stage.

## GALVANIC BATTERIES.

By ALLAN TRAYNOR.

V.—DOUBLE-FLUID CELLS—THE DANIELL CELL—DESCRIPTION OF THE PARTS—SPRAGUE'S MODIFICATION OF THE DANIELL CELL—CONSTRUCTION OF THE DANIELL CELL—THE POROUS JARS—THE ZINC ELEMENT—THE EXCITING FLUIDS—IMPROVED FORM OF DANIELL CELL—THE E.M.F., AND USES OF THE CELL.

**U**NOW come to double-fluid cells. It has been shown that the fault of single-fluid cells is their inconstancy arising from polarization. This fault, however, does not render them absolutely useless, unless they are put to work for which they are unsuited. No one would think of setting the Leclanché to yield a long-sustained current of high electromotive force, or of setting the bichromate to the

work of electro-gilding, where a weak but continuous current would be wanted. Each form of cell has its own proper work—to yield a weak or a powerful current, for a long or a short time, as the case may be. Whenever polarization occurs the current ceases.

The employment of two fluids, with a porous

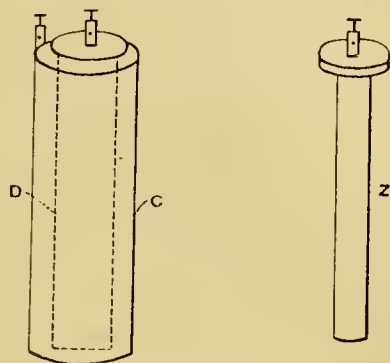


FIG. 12.—DANIELL CELL.

C, Copper Containing Vessel; D, Porous Jar containing zinc element; Z, Zinc rod furnished with wooden cap.

partition between them, obviates this fault to a very great extent. The zinc is immersed in one fluid, and the negative element in the other, this latter fluid being called the "depolarizer," as it absorbs the hydrogen which would gather on the negative element. The porous partition is to prevent a too rapid mixture of the two liquids.

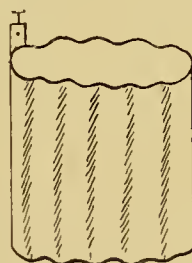


FIG. 13.—CORRUGATED COPPER CYLINDER FOR DANIELL CELL.

*The Daniell Cell.*—The first of the double-fluid cells to be noticed is that which bears the name of its inventor, who was one of the most distinguished scientists of the century. It was invented in 1826. The elements are zinc and copper. The copper, however, is in the form of a containing vessel, and serves the double purpose of being outer jar and negative element.



Fig. 12 represents the usual form. A copper vessel, *c*, contains a porous jar, in which is placed a rod of amalgamated zinc. As the zinc should not touch the porous jar at any part, it is usually furnished with a round lid of hard wood, which rests on the mouth of the porous jar. The liquid for the porous jar is dilute sulphuric acid, in the proportion of one part of acid to ten or twelve of water. In the copper vessel, the liquid is a saturated solution of the blue crystals known as sulphate of copper. When the cell is in action a deposit of copper takes place upon the inner surface of the copper vessel. By this means the surface is kept clean. If the solution be kept well saturated with sulphate of copper, the negative element can be maintained in a constant condition for work. The acid solution, however, is apt to become clogged in its action by the dissolving of the zinc.

The main objection to the cell is that, the sulphate of copper, passing through the porous jar into the zinc solution, forms a deposit of copper on the zinc rod. This means local action and a decrease of current. An arrangement suggested by the eminent electrician, Mr. J. T. Sprague, is the employment of two porous jars—the larger one to contain another of a smaller size which holds the zinc, the space between them being filled with a strong solution of sulphate of zinc and some zinc cuttings. This decomposes any copper salts which may enter, and the inner cell is thus kept, to a great extent, free. For long-continued experiments where constancy is important, this arrangement is admirable; but it must not be forgotten that the internal resistance is increased.

*The Construction of the Daniell Cell.*—There are various methods of constructing Daniell cells. The commonest form is the cylinder of copper for the outer cell, the usual sizes being 6 inches deep by 3 inches diameter; 9 inches deep by 4 inches diameter; and 12 inches deep by 4½ inches diameter. Some forms have a perforated shelf for holding the supply of copper salts. Others have a reservoir, with the part of the cylinder within it perforated.

An outer vessel of copper is not really necessary. A glass or earthenware jar may be used

having a cylinder of sheet copper within it, either plain or corrugated. By corrugating the copper a much larger surface is brought into action than when a plain cylinder is used, and thus the quantity of the current is increased.

To corrugate sheet copper two round sticks are required, each ½ inch diameter and about 1 foot long. The strip to be corrugated should be about three times the length that would be required for a plain cylinder. Place one stick *on* the copper, and bend the latter half-way round the stick; place the other stick *under* the copper, and bend the copper round it. The first stick is now withdrawn and placed on the metal as before, and the process repeated till the corrugation is complete. A binding screw, or a

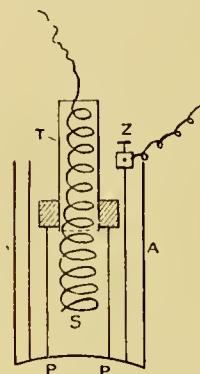


FIG. 14. — IMPROVED FORM OF DANIELL CELL (SECTION).

*S*, Spiral of copper wire passing through glass tube, *T*, which is tightly fixed into porous jar, *P*; *Z*, Zinc cylinder in outer jar, *A*.

short length of stout copper wire, should be soldered to the edge of the cylinder for connection. Fig. 13 shows the form of a corrugated copper cylinder.

*The Porous Jars.*—These should be always an inch or two higher than the copper cylinder. Their bottoms, and also the part which is above the copper cylinder, should be rendered non-porous. To accomplish this, the parts referred to are held in a very small quantity of melted paraffin wax, till the wax has been soaked up as far as it may be wanted. When jars are purchased with their upper parts glazed, this treatment will not be necessary so far as the glazed parts are concerned. The reasons for such precautions in the case of the porous cells are, in the case of the upper parts, to prevent the creeping of salts from the outer solution up the side of the porous cell into the inner solution; and in the case of

the bottoms, to prevent any local action arising from the outer solution acting on the particles of zinc which fall to the bottom of the porous cell.

Porous jars taken out of the liquids should not be laid aside anywhere. They should be kept soaking for some time in water, so that all salts may be drained out of them.

*The Zinc Element.*—The zinc need not necessarily be in the form of a rod. A plate answers quite as well, but it must not be of such breadth or length as to touch the porous cell either at its sides or bottom. To prevent the latter, the simplest plan is to bore a hole through the zinc near the top, into which a pin of hard wood may be fitted. Have the pin of such a length that its ends rest on the sides of the porous jar. Or, if boring the zinc be an objection, it may be passed through a rough slit made in a flat piece of wood. The zinc must be amalgamated, and a binding screw soldered to it.

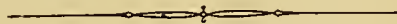
*The Exciting Fluids.*—The most commonly employed fluid for the porous jar is dilute sulphuric acid. Where long-sustained work is not necessary, as in telegraphs or electric bells, the fluid may be water only. Where the work is long-sustained, as in some forms of electric clocks, the best solution is one of sulphate of zinc. This can be kept in working order by occasionally taking away a little and adding the same quantity of water.

When the Daniell cell has been in action for some time a slight deposit of copper takes place on the zinc. The plate should, therefore, be taken from the solution occasionally, and the deposited copper removed. When it is desired to put a battery out of action it is better not to break the circuit entirely, but send the current through a high resistance, such as a long spiral of fine iron wire. The slight current passing drives the solution to the copper, and so prevents it from going to the zinc.

*Improved Form of Daniell Cell.*—The following arrangement is due to Mr. Clement H. Wragge, and completely arrests the tendency of the copper solution to creep over the porous pot into the zinc solution. There is still a mixture of the two solutions, but only through the porous

pot. The arrangement (Fig. 14) consists of a porous pot 1 inch shorter than the outer glass or earthenware containing vessel. A piece of glass tube, 4 inches or 5 inches long, and smaller in diameter than the inside of the porous pot, has one of its ends wound round with tape until it fits the pot tightly. This end is soaked in melted wax and placed in the porous pot, the joint being covered with wax and allowed to set. This cell contains the sulphate of copper solution. The copper element is made of a few yards of copper wire, wound into a close spiral, which drops through the glass tube into the porous cell, a length of the wire being left to form the outer connection. The zinc is in the form of a cylinder, and is placed in the outer vessel which is charged with sulphate of zinc solution. A few crystals of sulphate of copper are placed in the glass tube. It improves the cell to cork this tube, passing the wire through the centre of the cork. The solutions should be level with each other, and high enough to cover the joint between glass tube and porous pot. This form of cell is admirably suited for working electric clocks.

*E.M.F., and Uses of the Daniell Cell.*—The Electromotive force of the Daniell cell is usually stated to be 1.079 volt. In ordinary cases it is considered as 1 volt. This being the unit of Electromotive force, the Daniell is adopted as the standard cell. It is admirably adapted for the electro deposition of copper, silver, and gold, for working electro-magnets, telegraphs, and electric bells.



**LIQUID GLUE.**—A liquid glue possessing great resisting power, recommended for wood and iron, is prepared, according to Hesz, as follows:—Clear gelatine, 100 parts; cabinet-makers' glue, 100 parts; alcohol, 25 parts; alum, 2 parts; the whole mixed with 200 parts of 20 per cent. acetic acid, and heated on a water-bath for six hours. An ordinary liquid glue, also well adapted for wood and iron, is made by boiling together for several hours 100 parts glue, 260 parts water, and 16 parts of nitric acid — *English Mechanic*.

## AMERICAN ORGAN BUILDING.

By THOS. L. WINNETT.

## IV.—ORGAN FRONT—FOOT-BOARD—BLOW PEDALS.

**Q**UR last task, considered in the previous chapter, was that of regulating the keys. Supposing that to be accomplished satisfactorily, we will leave the internal work for a time, and resume the construction of the case. This compulsory change of work is rather a good thing in American organ building; it keeps up the interest in the work better than if we had to keep at one part, say, the case for instance, which would take the builder so long that perhaps he might get tired of the job hanging about, and would commence something smaller. Everyone knows the tendency of the much-abused amateur in this respect if the work be rather tedious, to which failing I must confess myself to have fallen a victim at times. But we are not going to give up yet, are we? Our purpose is to conquer all difficulties, and keep steadily on to the end, until the complete instrument stands in our parlour or drawing-room, proud of its maker. Before the blow pedals can be connected to the action, the front board must be made. Fig. 29. Prepare the parts, A, B, and C, according to the dimensions shown in the illustration, of  $\frac{3}{8}$  inch walnut. The front surface only need be planed, but that must be done nicely, finishing with the scraper. Place the parts in the position shown in the figure. They must be kept together, and strengthened at the back with two cleats (D), made of, say,  $\frac{1}{2}$  inch pine or deal. Glue and screw on with short screws from the back, taking care not to let them come through to the front surface. The dimensions of the whole front board should now be 3 feet 4 inches long, 2 feet 1 inch in height, and  $\frac{3}{8}$  inch thick.

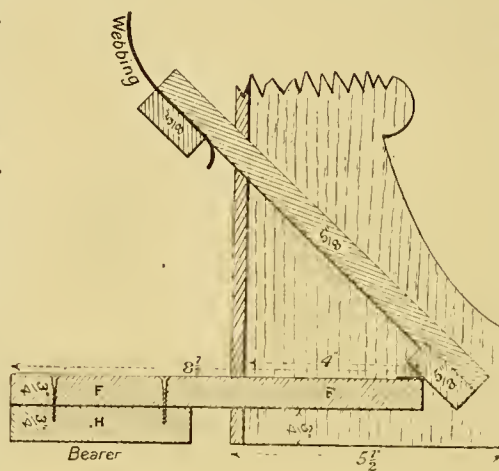


FIG. 33.—METHOD OF FIXING BLOW PEDALS AND BEARER. SCALE, 3 IN. TO 1 FT.

If you now refer back to Fig. 15, you will see a perpendicular dotted line near the front of the organ. A groove  $\frac{1}{2}$  inch deep and  $\frac{3}{8}$  inch broad must be cut in the inside of each organ end in this position, 16 $\frac{1}{2}$  inches from the back. This is to take the organ front; but more of this later on. I should have said that we need not be careful to make the joints in the front board perfectly invisible, as they will be covered by the parts, H, in Fig. 30. Cut these parts out with a scroll saw, and finish off with the chisel and spokeshave, in the same way as the scrolls on the organ ends were done. The thickness of wood used must, of course, depend upon the

thickness of the organ ends; but it must not be less than one inch. A moulding (M, Fig. 30) must be run on the edges at the places marked in the design; it will greatly enrich the effect, and is very easy to do with the reeder, described in Chap. II. There is just one point in putting on the moulding, that I must mention. In commencing from the top, when you come to the part marked H, don't run it right up to the end, but stop abruptly, say,  $\frac{1}{2}$

inch away; it will thus have a much better effect. You will see that I have given alternative designs in Fig. 30. They both look nice, but the choice must lay according to the individual taste of the builder. The part, I, has three half-round beads running across the grain, but as this cannot be worked with the reeder, it must be carefully cut with a small saw and chisel, finishing off with sand-paper and files.

Before screwing the scrolls in position, a slot 4 inches long,  $\frac{3}{4}$  inch wide, and  $\frac{1}{2}$  inch deep, must be made on the inside of each scroll  $\frac{3}{4}$  inch from the bottom edge. This is to take the board, F, Fig. 31.

The scrolls had better now be fixed. Glue and screw on to the front board, over the joins



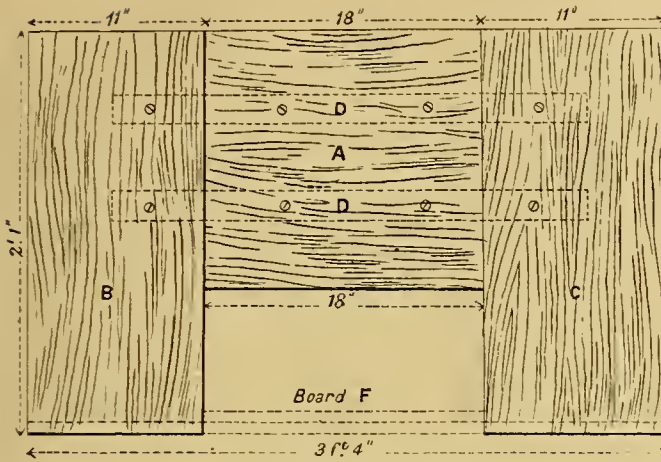


FIG. 29. Front Board

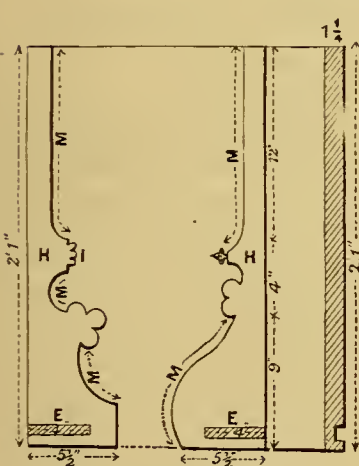


FIG. 30. Scrolls for front board

Scale of Figs. on this page 1 1/2 in. to 1 ft.

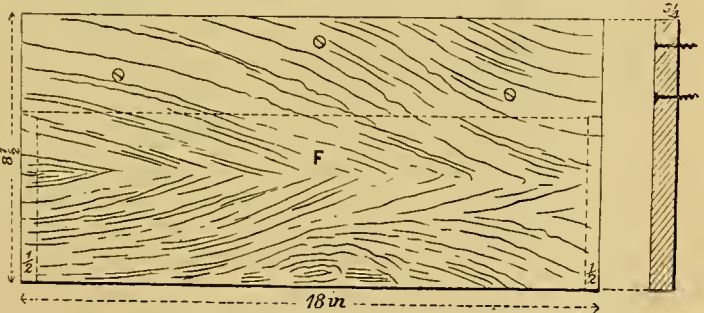
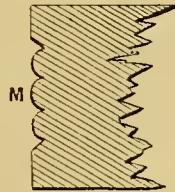


FIG. 31. Board to fix blow pedals upon

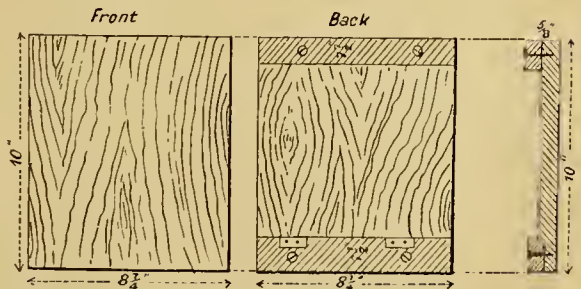


FIG. 32. Blow Pedals.

into the grooves prepared for it, and also slide in the board, F. Then mark the place on the front bearer where the board, F, will come; slide the front out again, make the three screw holes for board, F, and screw down; take it off again; once more slip the front board into position; then, lastly, the board, F, may be again slid into its grooves, and fixed finally on to the bearer. The whole thing should now be quite firm. You can, if you like, use glue for fixing both the front board and bearer, but I find the method described more convenient if wanted to be removed at some future time for repairs.

The blow pedals must next have attention. Fig. 32 shows the measurements. Ordinary deal will do, strengthened at the top and bottom with 1 1/2 inch cleats. The width of each pedal is given as

(screws to be put in from the back), and so that the inside edges overlap the bottom opening just 1/2 an inch. Next make the board, F. A glance at Fig. 31 will show the sort of board required. Make it preferably of some hard wood, 3/4 inch thick. It is to be screwed firmly on to the front bearer, connecting the two sides of the organ (H, Fig. 15) with three stout screws; and the best method of fixing the whole thing in position will be this: First slide the front board

8 $\frac{1}{4}$  inches. This will leave a little space for them to work in clear of the sides. They should, however, to look nice, be fitted as close as is possible with free working, so that this measurement should not be adhered closely to if the space in which they are to work differs. The hinges are not to be fixed at the *end* of the pedal, but on the upper edge of the cleat, but this also will vary a little with each instrument. Use 1 $\frac{1}{2}$  inch butt hinges, of course, a pair for each pedal. You can sink them or not, whichever you prefer, as they are not seen.

If I have not made this part of the work clear to everyone, Fig. 33, showing a side view of the blow pedals, will, I think, help over the difficulty.

To connect the pedals to the lifters, use stout webbing 1 $\frac{1}{2}$  inches broad. About 2 feet will be required for each pedal. Attach one end to the top of lifter opposite the roller, by means of a small square of wood fixed with two screws; pass the end over the roller and bring it down to the pedal. In order to fix it to the pedal, the organ must be turned on its side; it can then either be fixed under the cleat, by undoing the screws, or tacked to the top of it. The former is the neatest way. Let me here caution you against having the pedals pulled up too high, it strains the bellows somewhat when blowing, but make them just high enough, so that the tops are not seen when looking at the organ front a little distance off, allowing for a moulding which we will presently put over the part cut out for blow pedals. The pedals had better not be carpeted until the organ is complete.

Now I do not know how it will be with those of my readers who have followed the instructions thus far, and been successful in their first attempt at American organ building, but I do know that when I arrived at this point in the proceedings, I could not resist the temptation to try the capabilities of the instrument, although incomplete. Well, to those frail amateurs who cannot resist any longer, I will let them into the secret of being able to play without the completion of the stops. If you prop open the bottom pair of mutes at the back, you will bring into action the Diapason reeds, 8 feet tone, same

pitch as pianoforte; now treat the front row in the same manner; these are the Principal reeds, 4 feet tone, that is, one octave higher; next, the upper half of the top row at the rear, and you have the treble, an octave lower, 16 feet, or Bourdon tone. The last set to open is the Viola reeds, of same pitch as the Diapason row, only varying in quality. This is only *half* the power of the instrument. When we get our octave couplers and Sub-bass fixed, we shall find what a volume of tone can be obtained, and quite enough variety to keep us amused for hours in finding out the different combinations. But we must not waste too much time in playing, else our task will never be done.

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## WOOD-TURNING FOR BEGINNERS.

By W. WILLIAMSON.

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### IV.—A WHATNOT IN TURNED WORK—WORKING DRAWINGS—PUTTING WORK IN THE LATHE—ROUGHING DOWN AND SMOOTHING A PLAIN CYLINDER.



HAVING given so much consideration to our lathe and tools, I have no doubt some of my readers begin to think it is time we commenced work, and I am of much the same opinion myself; so we will suppose that our lathe is fixed up in a good light place in the workshop, with a board behind on which to place our patterns and tools, that the tools are all in working order, and now the question arises, "What shall be our first job?"

If I tell my pupils to procure some short pieces of wood for no other purpose than to practice on, it is just possible that not one in ten will obey me. The young musician gets very tired of first exercises and longs to be hammering away at some good old tune, though it may be only to murder it. Young artists get heartily sick of making straight and curved lines, their fingers fairly itch to be sketching a real picture which they can exhibit to their friends. All young mechanics desire to be at something which, when finished, shall be of either use or ornament, and the wood-turner is no exception to the rule, so in order that, even in his first labours, he may have something definite in

view, I have designed the small hanging whatnot, shown in Fig. 29. I have advisedly chosen a small article, that the parts may be all within the scope of a very small lathe, and, while I have endeavoured to make the pattern simple enough for the beginner to attempt with a fair chance of success, I have also tried to contrive something which, when finished, will be in some degree worth the time and trouble bestowed upon it.

It is not to be expected that the amateur, who is quite new to lathe work, will complete the job without spoiling a few pieces, so it will be well to begin with some inexpensive wood. Red deal or yellow pine will answer our purpose; either of these will turn easily, and if a few pieces are wasted the expense will not be great. This latter consideration will perhaps have some weight with those who would otherwise hesitate to undertake the making of an article composed of so many parts; but don't be afraid, we must expect a few failures at first, and if, after doing our best, our whatnot should not turn out quite so well as could be wished, then the judicious application of a little putty, and a coat of Aspinall's Enamel will cover a multitude of flaws. Now, please, don't misunderstand me, I am not recommending a careless, slipshod style, simply because bad work can often be hidden under a coat of paint; whatsoever the subject the learner's aim should be *perfection*, but we have to be content with many things which fall far short of that high standard, so we will not utterly condemn the turner's first production, because it is not equal to the work of an experienced hand.

Before beginning any piece of work composed of a number of parts it is advisable to make a working drawing. Figs. 30 and 31 are drawn to a scale of 3 inches to 1 foot, or one-fourth of full size; but as the complete article is small, the amateur may as well reproduce them full size, he will then see exactly what he has to do, and the quantity of material he requires; if, however, he prefers to work to the drawings given, it will, perhaps, save trouble, if I supply the following list of pieces and their dimensions:—Front columns (*a*), two pieces 10 inches long,

1½ inches square. Four knobs (*b*), four pieces 2 inches long, 1½ inches square. Spindles (*c*), nine pieces 2½ inches long, 1 inch square. Half columns (*d*), two pieces 10 inches long, 1½ inches wide, ½ inch thick. Four brackets (*e*), one piece 4½ inches long, 4½ inches wide, ¾ inch thick.

The above are all the parts which require turning, it will be observed that the lengths specified are all slightly longer than finished sizes, and the beginner must remember, as a general rule, in sawing out wood for turned work, that all pieces which require turning to the extreme ends must have an extra ½ inch allowed to avoid running the tools against the lathe centre.

The unturned parts are:—Shelves (*f*), two pieces 16 inches long, 4¾ inches wide, ½ inch thick. Back uprights (*g*), two pieces 16 inches long, 1½ inches wide, ¾ inch thick. Rails (*h*), two pieces 12½ inches long, ¾ inch wide, ½ inch thick; with regard to these I may say here that, as my subject is turning and not cabinetmaking, I have arranged for as little of the latter as possible, but I cannot avoid it altogether; doubtless, many of my readers will be able to easily manage the small amount of fitting required, but for the benefit of those who are not so experienced, I will briefly describe all that is needful as we proceed:

If the amateur buys his wood all ready cut out with the unturned pieces planed up, it will cost a trifle more, but will save some trouble; but if he prefers to do the whole of the work himself, he must select some dry wood, which is perfectly free from shakes, and as far as possible from knots; and in sawing it to the required sizes, be careful to cut it square; this is important, and cannot be too strongly insisted on, if unaccustomed to the use of a saw, the beginner had better mark his thick stuff on both sides, being careful to have his lines exactly opposite each other, and by occasionally looking at the underside, he will see if the saw has a tendency to run wild, if it leaves the line turn the plank over and saw from the other side, and repeat the process as often as may be necessary; this is not exactly a workmanlike method, but it will perhaps enable an amateur to avoid wasting a



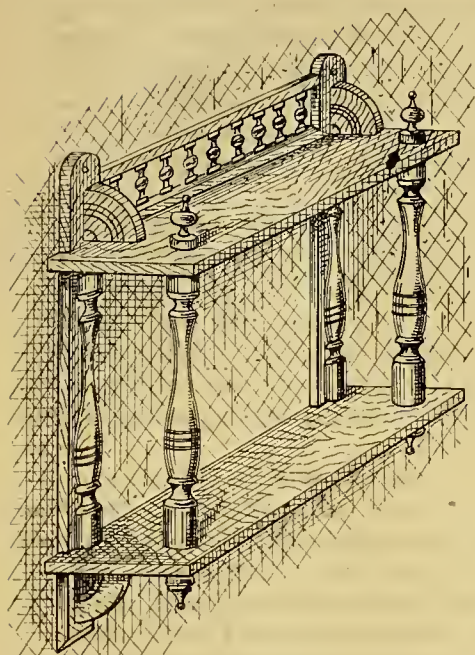


FIG. 29.—A HANGING WHATNOT IN TURNED WORK.

strip of wood, and therefore is not to be despised until the hand becomes proficient.

The saving finished, the next thing to do is to glue up the two pieces (*d*), with a strip of paper between them, they will then be drying in readiness for turning. To accomplish this, plane one side of each piece until the two planed surfaces make a close joint when placed together—a few thin shavings, just enough to remove the rough, should be sufficient—now take a strip of paper, a little longer and wider than the wood, and about the thickness of the yellow covers of *AMATEUR WORK*, and lay it on a piece of flat board, cover the planed side of one of the pieces of wood with thin glue, as hot as can be, and quickly lay the glued surface on the paper, rub it backwards and forwards until it is

bedded down on the paper with as little glue left between as possible. Now lay this with paper upwards, glue the other piece of wood, lay it on the paper and repeat the rubbing process, being careful at the finish to bring the edges of both pieces true and square with each other. When dry, pieces jointed in this way can be turned as one, and afterwards divided by inserting a chisel in the joint.

One of the front columns (*a*) will be the most convenient piece for a first lesson in turning, but before putting it in the lathe it is necessary to find and mark the centre of each end. This can be done by drawing lines from corner to corner, as Fig. 32, or by using a pair of compasses, but a more expeditious method is

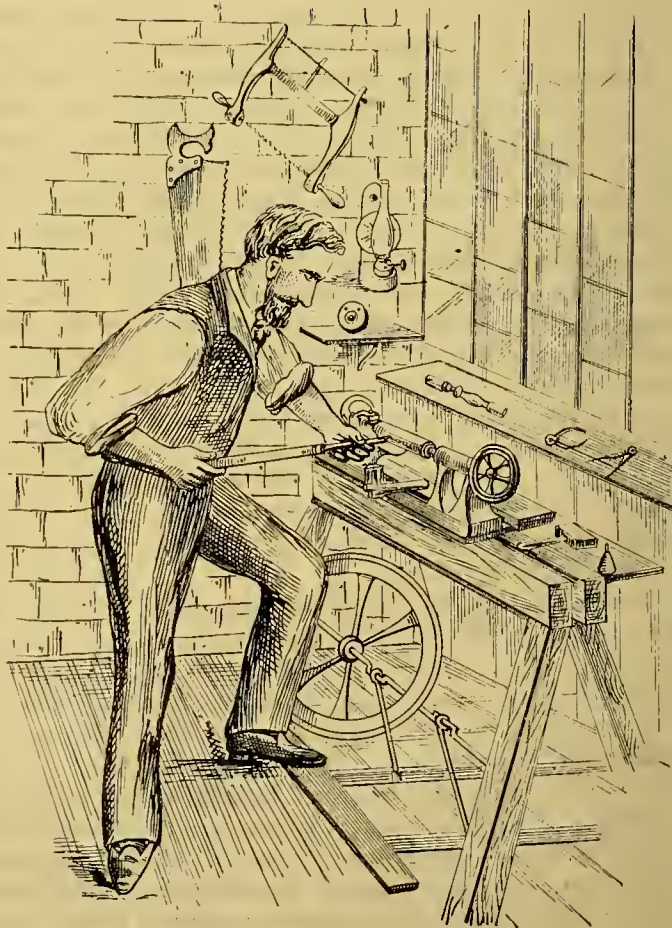


FIG. 36.—TURNER WORKING AT LATHE.

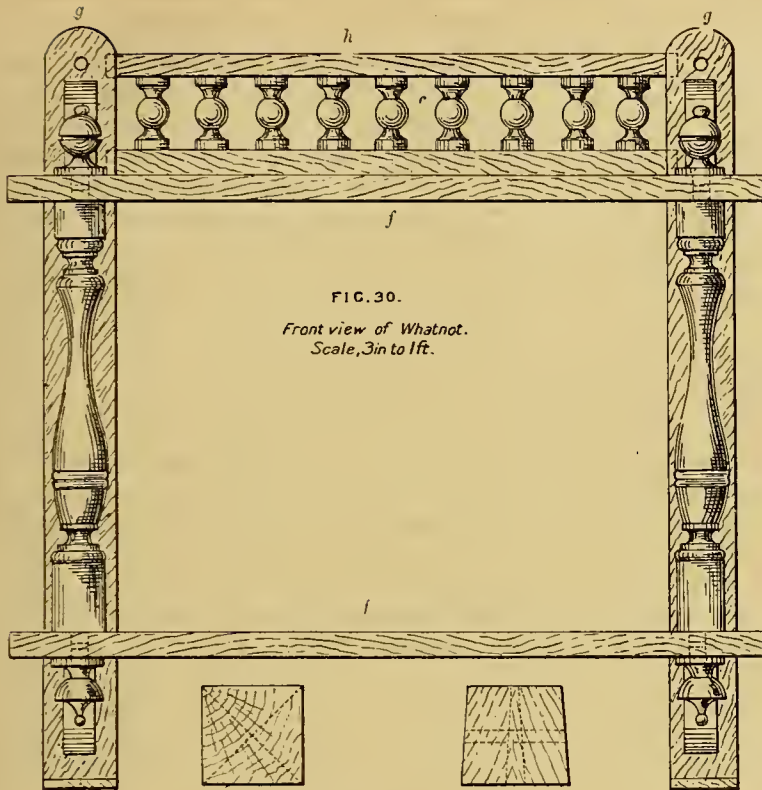


FIG. 30.  
Front view of Whatnot.  
Scale, 3in to 1ft.

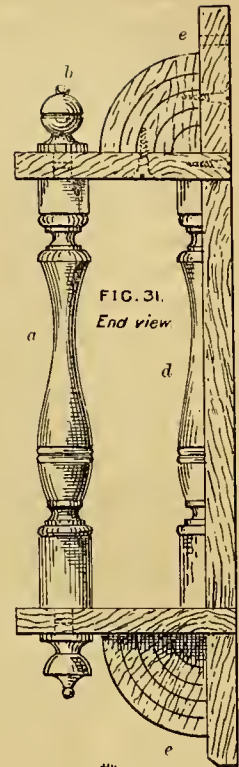


FIG. 31.  
End view



FIG. 32.

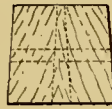


FIG. 33.

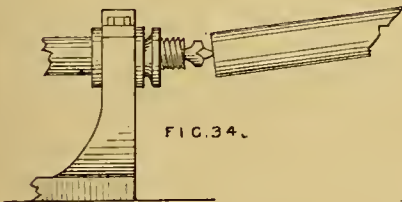


FIG. 34.

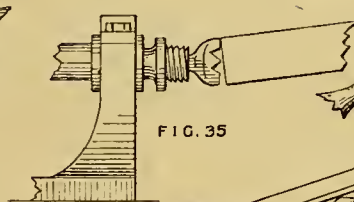


FIG. 35.

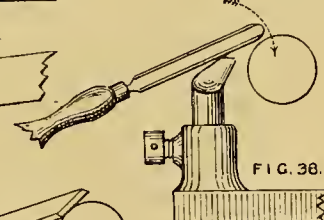


FIG. 38.

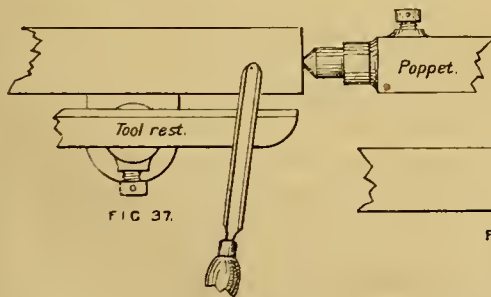


FIG. 37.

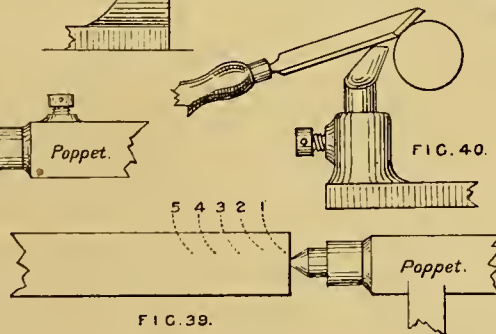


FIG. 39.

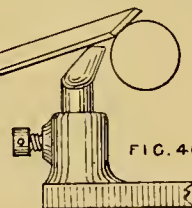


FIG. 40.

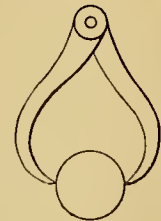


FIG. 41.

FIGS. 32, 33.—METHODS OF MARKING CENTRES. FIG. 34.—PUTTING WORK IN LATHE, CENTRE IN RIGHT POSITION. FIG. 35.—CENTRE IN WRONG POSITION. FIG. 37.—TOP VIEW OF WORK, SHOWING ANGLE OF GOUGE ACROSS TOOL REST. FIG. 38.—ELEVATION OF GOUGE ON TOOL REST. FIG. 39.—FIRST CUTS IN ROUGHING DOWN. FIG. 40.—CHISEL IN POSITION FOR SMOOTHING WORK. FIG. 41.—METHOD OF APPLYING CALIPERS.



to set an ordinary marking-gauge to about half the thickness of the wood to be operated on, and mark the end of the column from all four sides; of course, if the gauge is set to exactly half the thickness, and the wood is perfectly square, the gauge lines will form a cross in the middle, but the chances are against this, and the marks are more likely to be as Fig. 33. This, however, is quite near enough to show the centre, and having marked both ends make a hole in each with a small bradawl.

If we had large square pieces to deal with, it would be a great saving of labour to roughly reduce them to an octagon shape by removing the corners with an axe or draw-knife, but as our wood is only  $1\frac{1}{4}$  inches square, the gouge will round it readily enough, so we will proceed to mount it in the lathe.

Now the putting of this piece of wood between the lathe centres, and turning it into a column for our whatnot, seems to me a most ridiculously simple affair, and I could show you the whole process in a very few minutes, but to describe it intelligibly on paper is not so easy, and will take much longer. I cannot be close at hand to assist you, so I must ask you, kind reader, to draw a little on your imagination, and suppose that you are watching me while I am doing the work; by the help of a few sketches I hope to make the various movements understood, and I trust the somewhat long description of a small matter will not prove tedious.

I first insert the prong centre in the mandrel nose, and then slide up the movable headstock until there is about  $10\frac{1}{2}$  inches between the centre points, and secure it there by means of the holding-down bolt. Now, observe, I turn the prong centre until the edges lie in a horizontal direction; I take the piece of wood which is to form our column in my left hand, and place the bradawl hole, previously made in the end, on the point of the lathe centre, I keep the other end slightly elevated (see Fig. 34), and give it a sharp tap with a mallet; this imbeds the prong centre firmly in the wood; I now depress the other end until the second bradawl hole is opposite the poppit centre, and turn the hand-wheel until the centre has penetrated the wood

for a  $\frac{1}{4}$  inch or so; the work is now mounted "between centres," but in its present state it would run fearfully hard, so I reverse the hand wheel for about half a turn, which slightly withdraws the centre, and having applied a drop of oil where the wood revolves, it now runs easily. I next tighten up the set-screw, to prevent the sliding mandrel getting loose, and adjust the tool rest with the T, very slightly above the height of the lathe centres, and just far enough away to allow the wood to revolve freely, and we are ready for action.

But before we go on allow me to explain one or two little things of which you, perhaps, did not quite see the why and wherefore; you saw me turn the prong centre until the edges were level, and when I struck the wood both wings entered at once. If the prong had been in an up-and-down position (see Fig. 35), one wing only would have entered, and the chances are it would shift before the work was half finished. Again notice, I use a mallet in preference to a hammer; it is very easy to give the lathe poppit an accidental rap occasionally, the sharp edge of a hammer face does not improve the appearance of polished iron, but a mallet leaves no tell-tale marks behind. Another word about taking care of your lathe, if the set-screws of the poppit and tool rest have capstan heads, that is, round cheese-shaped heads with holes drilled in the edge, use a little round lever (commonly called a "tommy") to turn them, and never tighten them up with the square tang of a turning tool or file, or your screw heads will soon be badly disfigured. Attention to little things of this kind will keep a lathe in good condition for a very long time.

As we have so small a piece work to execute, we require it to run fast, so I adjust the driving strap from the largest diameter of the flywheel to the smallest mandrel pulley, and this will give the highest speed of which the lathe is capable. In speaking of speed, I am not referring solely to the number of revolutions made in a given time, but to the rate at which the surface of the wood passes the cutting edge of the tool, and this is governed to a great extent by the size of the work itself; for example, the little



column we have in the lathe is to be, when finished, 1 inch in diameter. Now, if we make sixty treads in a minute and each tread gives us, say, ten revolutions of the mandrel, our work has a surface speed of nearly 160 feet per minute; this is a very moderate velocity and can be kept up without difficulty, but if, without shifting our strap, we were to attempt a 6 inch piece of work, although the number of revolutions per minute would be the same, the surface speed would be six times as great, and the labour of driving would be beyond our power; therefore, for large work we drive from a smaller diameter on the flywheel to a larger pulley on the mandrel, by which means the speed is decreased and our power economized in a corresponding degree. Experience will soon teach you what speed to work at. You need never be afraid of driving too fast, so long as your lathe runs without too much shaking, and you do not unduly fatigue yourself; the limit is not found in the speed at which a sharp tool will make good work, but rather in the turner's leg.

But to resume work. I stand firmly on my right foot, and start the lathe with my left; not by suddenly jerking my whole weight and strength into the business. That is the way to strain something or other, and, perhaps, bend the crank of a light lathe; but by the steady downward action of the foot alone. I apply more force on the second stroke and soon have the lathe running at full speed.

I next take the largest gouge and lay it on the T-rest, about half an inch from the right-hand end of the work, the round side downwards and the cutting edge elevated a little above, and clear of the revolving wood; my left hand firmly grasps the blade close up to the T-rest, the back of my hand being uppermost. I hold the handle of the tool in my right hand, and for greater steadiness I press my arm against my side. Fig. 36 shows the position. A tool held in this way is quite under control, and the danger of its digging in is reduced to a minimum. The hollow of the gouge is turned slightly to the right, and it is slanted on the T-rest, with the edge a little in advance of the handle (Fig. 37). I now steadily raise my right hand which

depresses the point of the tool below the level of the revolving work, and the foggy outline of the square corners immediately flies away in the form of chips; I move the gouge about half an inch to the left and repeat the cut, and so on until the whole length has been gone over. The dotted lines in Figs. 38 and 39 show how the cuts are made.

The corners are now removed, and to make the surface a little more smooth and bring the column nearer to finished size, I take a light continuous cut from end to end, sliding the gouge on the T, and being careful to maintain the same depth throughout.

The roughing-down is now complete, so I replace the gouge on the tool-board; please note, on the tool-board, and not simply across the lathe bed or it would soon shake off. Having set a pair of calipers to 1 inch, I take up the largest chisel; this tool is held in the same way as the gouge, and is laid on the T-rest, slanting in the same direction, the edge across the work, as shown in Fig. 40, and its lowest corner bearing on the T.

I begin in the middle of the column, and take off light shavings to the right hand until I find by applying the calipers that I have gone deep enough (see Fig. 41). I now turn the chisel over and work to the left, until the column is smooth and of one size throughout its length; it is now ready for marking and turning the pattern, which will receive attention in my next paper.

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## PIPES AND PIPE-CUTTING.

By L. L.

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CUTTING SOFT METAL PIPE—SHEET IRON STOVE-PIPE—  
IRON BARREL—BRASS AND COPPER TUBE—CAST IRON  
PIPE—HOT-WATER AND MAIN PIPES.



**K**NOWING that many of my brother amateurs often have little jobs to do that involve using various kinds of metal pipe, I thought that a few hints on the cutting of different kinds of pipes would be very acceptable, as it is quite possible that some of the methods may not be generally known to amateurs, though, of course, to the professional

workman in the various trades using metal pipes they will be familiar.

Small soft metal pipes, such as those for pneumatic bells, compo. gas tube, block tin spirit pipe, and lead pipe not larger than  $\frac{1}{2}$  inch diameter, may be cut with a knife—running the knife round the pipe, with the thumb placed the other side; it need not be cut fairly through for

best to use, but the edges of a square or a flat file will answer nearly as well.

*Iron Barrel.*—This includes gas, steam, and water-pipe, of a diameter from  $\frac{1}{4}$  inch to 2 inches or larger, these tubes are cut by means of a file or patent pipe-cutters, the pipe being fixed in the vice. These pipe-cutters are very useful tools, effecting a great saving of time

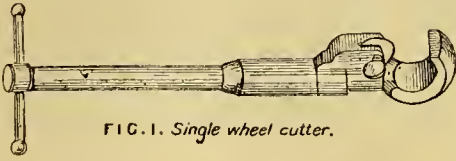


FIG. 1. Single wheel cutter.



FIG. 2. Three wheel cutter.

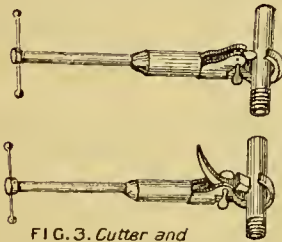


FIG. 3. Cutter and  
Pipe wrench combined.

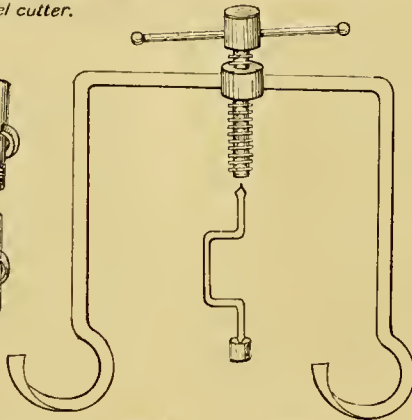


FIG. 7. Apparatus for drilling pipes.

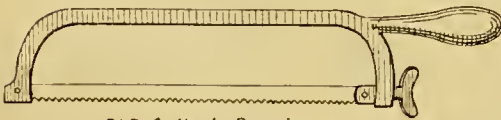


FIG. 4. Hack Saw.

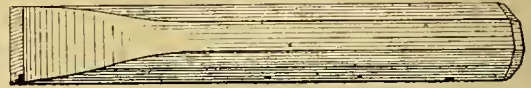


FIG. 5. Cold Chisel.

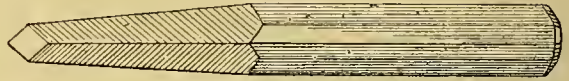


FIG. 6. Diamond point.

and rendering the work much easier. Figs. 1 and 2 show two of these cutters; one is a single-wheel cutter, and the other a three-wheel cutter; the advantage of the three-wheel over the single-wheel is, that it need not be run right round the pipe, thus rendering it useful for cutting pipe that is a fixture in any place difficult to get at, the size is regulated by the handle at the end; each cutter will cut several sizes of pipe—the prices, to cut from  $\frac{1}{4}$  inch to 1 inch, is 12s. 9d.;  $1\frac{1}{4}$  inches to 2 inches,

18s. for the single-wheel; and 16s. 6d. and £1 6s. for the same size in the three-wheel.

Fig. 3 shows a Patent Combined Cutter and Pipe-wrench or Tongs, this is only a single-wheel cutter, but its having the advantage of being a pipe-wrench as well renders it a valuable tool; it is a very simple and effective tool and two sizes will cut and grip all sizes of pipe from  $\frac{1}{4}$  inch to 2 inches; prices the same as the three-wheel cutters. Messrs. Rhodes & Sons, Wakefield, Yorks, are the makers; the manner of using needs no explanation, a little oil should be used in cutting.

*Brass, Brass-cased, and Copper Tubes.*—These

it will break with a little pressure after the knife has marked it round.

Lead pipe of larger diameter than  $\frac{1}{2}$  inch is best cut with a saw; a stout tenon-saw is the best to use, a little grease will assist its progress through thick pipe; lead soil-pipe can be cut in the same way.

Sheet iron stove-pipe is best cut on a mandrel with a chisel, or, if this is not available, it must be cut with a file; a half-round one is the

pipes or tubes, which run from  $\frac{1}{2}$  inch to 3 inches diameter, may be cut with either file, or a hack-saw, Fig. 4; it is possible to cut the smaller sizes with a file, holding them by hand; but if cut by hack-saw they must be held in a vice. In the case of brass-cased tube, such as used for window curtains, etc., lead clams covered with brown paper must be used in the vice, to prevent the jaws of the vice damaging the lacquer. In cutting brass tube of large diameter, it is best to only let the saw cut one side of the pipe by lowering the handle of the saw, as when it is cutting on both sides of the pipe it makes hard work to drive the saw.

*Cast Iron Pipes.*—Thin, such as rain-water goods, must be cut nearly through with a file, and then rapped round with a thin keen-edged chisel, Fig. 5, when they will part easily enough, though it is sometimes very difficult to file these pipes, as they are frequently very hard on the surface, though, after the skin is got through, the metal is soft enough.

*Hot-water and Main Pipes.*—Cast iron hot-water pipe runs from 2 inches to 4 inches for all ordinary work. These are very easy to cut when you know the right way, which is as follows: Mark round the pipe with pencil or chalk, and then, with a sharp chisel, go lightly round to just mark it, then go round it again about twice, using the hammer with slightly increased force each time; it will usually part about the third time round. I have cut a 4-inch pipe in three minutes easily. But note, that it is not advisable to cut it in this way, if less than 6 inches from the spigot or small end; if less than 6 inches is to be cut off, the end should be slipped on the end of a mandrel or the beak of the anvil, and the chisel used, as before mentioned. Cast iron mains are thicker than hot-water pipe, and a slightly different treatment must be adopted. After marking, chip a groove round with a diamond point, Fig. 6, to a depth varying according to the thickness of the pipe to be cut, from  $\frac{1}{8}$  inch to  $\frac{3}{8}$  inch, then use the chisel in the same manner as for hot-water pipes and you will find very little difficulty in cutting them. Fig. 7 shows a handy contrivance for drilling main pipes or hot-water pipes, the sketch

needs no explanation, it can be made by any ordinary smith, and will be found of great service to anyone who has occasion to drill holes in these pipes. I will now conclude these remarks, with the hope that they will be found of some service to my fellow-readers

## HOW TO MAKE AN ELECTRIC CONDENSER, OR LEYDEN JAR.

By GREGORIE EDOUIN BEY.

ORIGIN OF THE LEYDEN JAR—FORM AND SIZE OF JAR—  
DETAILS OF CONSTRUCTION—MODIFICATIONS OF THE  
LEYDEN JAR—INTERESTING EXPERIMENTS WITH  
LEYDEN JARS.



QUAINT old story is told sometimes respecting the origin of a Leyden jar. A learned Professor, residing at Leyden, conceived the idea that, if electricity was a fluid, it might be dissolved in water and kept in a condensed state until wanted. He, therefore, procured a bottle of water, placed a conductor through the cork, and sent a number of electric sparks into the bottle. On attempting to move the bottle by taking hold of the conductor, he received such a violent shock as to thoroughly frighten him and cause a temporary illness. This discovery, accidentally made through error, soon got noised about, and led to the improved form of Leyden jars, as we know them, together with other forms of electric condensers.

The old time-worn theory respecting electric fluids is fast fading away, but Leyden jars remain to exemplify the possibility of storing electric charges, and show us, on a small scale, the effects of electrical discharges. It has long since been proved that electricity is not a fluid, and although the Leyden Professor succeeded in charging a bottle filled with water, he did not obtain electricity in solution with the water. The Leyden jars of the present day are not filled with water, nor with any other fluid, but are apparently empty bottles coated with tin-foil inside and outside too.

To make a Leyden jar, first procure a wide-mouthed bottle or glass jar, such as those which confectioners and druggists use for storing sweets and powders. The size of the bottle may



be anything between one pint and six pint capacity; but the smaller size will be found most suitable to operations with the Electrophorus, since it will not require so many sparks to charge it as one of a larger size. It will also be found to be quite large enough to comfortably grasp in the hand, and will be able to receive a charge quite as strong as most persons can bear, should it be accidentally discharged through the body, or should one purposely try its shocking effects. Large jars are not safe things to play with, as their charges are apt to do serious injury to delicate persons receiving the shock of their discharge.

We can always make up a strong battery of Leyden jars, by coupling up a number of small jars by their knobs for quantity. In selecting a bottle for a Leyden jar, choose one with thin glass in preference to those with thick sides, as these absorb the charge and do not readily yield it up on attempting to discharge the jar. As the jar is to be coated with tin-foil inside, a wide mouth is necessary, since it would be inconvenient to apply the foil to the inside of a bottle with a narrow mouth. Such bottles, however, may be used in making a variety named the "Spotted Jar."

Having selected the bottle or jar, next proceed to coat it with tin-foil. First cut out a piece of thin paper and fit it around the outside of the jar, so as to coat it to within 1 inch of the top. This will give the size and shape of the outer coat of tin-foil. A similar piece, cut to fit the inside of the jar, will give the size and shape of the inner coat of foil. Cut the tin-foil to those patterns and paste them with good flour paste, or stick them on with good varnish, one inside and the other outside the jar, so as to coat both sides with the foil. A disc of tin-foil for the bottoms, inside and outside, will complete the coats. Care should always be taken to get the surfaces perfectly smooth and free from bubbles or cracks. This done, we may fit a bung of baked and paraffined mahogany to the mouth of the jar, to form a convenient support to the stem or rod bearing the conducting knob. It is not necessary to make the bung air-tight, since its sole use is as a convenient support to the rod.

Indeed, we may do away with the stopper altogether, and employ instead a cross of wood coated with tin-foil, to rest on the bottom of the jar and form a support for the stem of the knob. But such a support would not conduce to the portability of the jar, which could not then be so readily handled, and handed from one to another. It is, therefore, preferable to have a bung of mahogany to support the rod, as shown at Fig. 7.

For convenience in charging and discharging the jar, we must employ a conductor insulated from the outer coating, but placed in connection with the inner coating of tin-foil. This conductor may be in the form of a straight brass rod, from 1 inch to  $1\frac{1}{2}$  inches longer than the depth of the jar; or a short piece of brass rod fitting into the bung, and connected with a piece of brass chain leading to the bottom of the jar. The first is shown at Fig. 5. The rod should be of  $\frac{1}{4}$  inch brass wire, with its top ending in a metal ball,  $\frac{3}{8}$  inch in diameter. Brass balls are sold for the purpose by electrical dealers at 3d. each; but a lead bullet will do equally well, care being taken to have it quite smooth and round. The end of the wire may be fitted into a hole in the ball, or the end may be screwed into the ball. As, in some experiments with the jar, it is found necessary to lift it by the knob, this should be firmly secured to its stem. The lower end must be fitted into a cross of wood coated with tin-foil, as shown at Fig. 5. This form can only be used with an opened-mouthed jar, such as that shown at Fig. 2. The second form, shown at Fig. 4, is used with the bottles sketched at Figs. 1 and 3. It consists of a short piece of brass wire surmounted by a knob of metal, but with its lower end connected to a piece of brass chain, such as a piece of clock-chain. This is sold by dealers at 4d. per yard; but a chain equally suitable may be made out of short pieces of wire turned into the form of bar links, as shown at Fig. 4a, and connected together. At Fig. 6 is shown a conductor with the top bent over to form a hook. This is used with jars being charged by an electric machine, the hook being hung on the conductor of the machine, and is, by some persons, deemed a more handy form for general experiments.

At Fig. 8 is shown a variety known as the "spotted jar." A glass bottle, of the shape shown at Fig. 3, is selected and first rinsed out, so to speak, with a small quantity of very thin varnish. Whilst the varnish is still wet, a quantity of brass filings is introduced and rattled around by shaking the bottle. Some of these will stick to the varnish and the rest must be shaken out. The outside must now be coated in a similar manner with varnish and then with filings. By controlling the spread of the varnish, and by wiping the inside of the neck with a piece of rag before placing the filings in the jar, its coating may be adjusted to the height shown in the figure, and the filings will become firmly fixed as the varnish dries. Whilst charging this jar, the spark will be seen to leap from one group of filings to another, and thus present a very pretty spotted or sparkling appearance. A similar effect is produced on discharging the jar, and it will be found that the charge does not escape all at once, as when the jar is coated with tin-foil; but, after the first discharge, a second, third, or even fourth discharge may be obtained.

A very pretty modification of this variety is shown at Fig. 9, and may be constructed by the exercise of some little labour and patience, out of an open-mouthed glass jar and some cuttings of tin-foil. The pieces of foil must be cut in diamond shapes, with their sides from  $\frac{1}{2}$  inch to  $\frac{3}{4}$  inch across, and a hole  $\frac{3}{8}$  inch in diameter, must be cleanly punched in the centre of each piece of foil. The pieces are first pasted all over the inside of the jar, with their points nearly but not quite touching each other. A band of tin-foil  $\frac{1}{2}$  inch in width is pasted around the top, as shown in the figure, to connect the tops of the pieces together. The outside of the jar is next coated in a similar manner, but in pasting on the pieces of foil, care must be taken to show the points of the inside diamonds through the holes in the centre of the outside diamonds, and the points of these should cross the holes in the inside diamonds. Whilst charging and discharging this jar, the sparks will leap from corner to corner of the pieces of foil and have a very pretty effect.

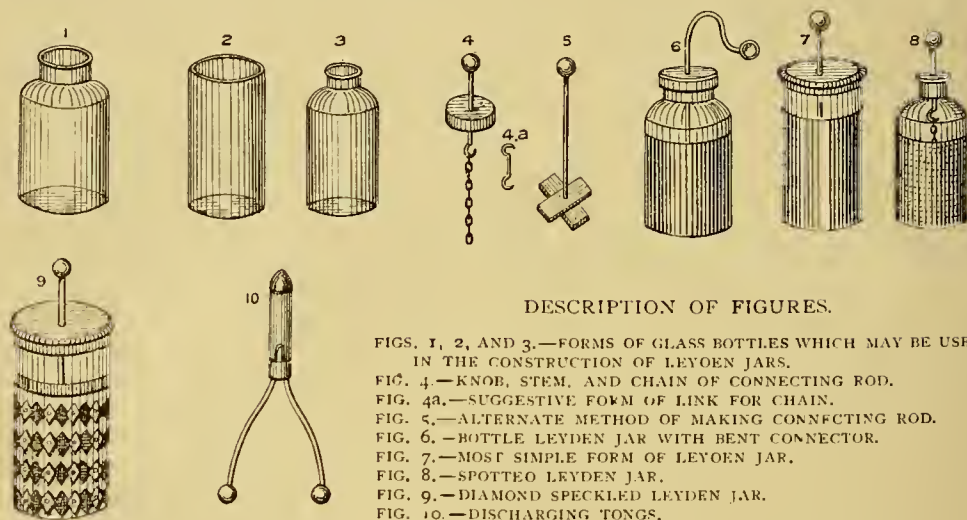
A similar effect can be produced on a pane

of glass. The glass must be coated on both sides with the tin-foil diamonds to within 2 inches of the edges. A narrow strip of foil is pasted along the upper row of diamonds on one side, and a strip from this up to the edge of the glass, to form a conductor. A strip of foil is also pasted along the points of the lower row of diamonds on the opposite side, and a strip from this to the lower edge. The pane, thus prepared, may be mounted on wooden feet to keep it in a vertical position. When coated with a plain sheet of tin-foil on both sides to within 2 inches of its edges, the pane will serve as a condenser instead of a jar. This leads us to observe that a condenser may be made in other forms, and act equally as well as a Leyden jar. A thin glass tumbler, for instance, will make an excellent condenser, and also furnish the means of performing an interesting experiment. First, make an outer case of thin sheet metal, to exactly fit the tumbler to within 1 inch of the top. This may be of sheet tin or sheet zinc, and will be in the form of a short metal tumbler when finished. Next, cut a block of wood to fit the inside of the tumbler to within 1 inch of the top, and coat this block of wood with tin-foil, then fix in it the usual stem and knob of a Leyden jar. Now, place the metal tumbler on a sheet of glass, put the glass tumbler in this, and put the block of wood in the glass tumbler. The whole can now be charged as a Leyden jar, then placed back on the pane of glass, and can be discharged by placing one finger of one hand on the knob, and the other on the outer metal tumbler. If, when thus charged and placed on a pane of glass or on a sheet of gutta-percha, we carefully remove the inner wood block and place this on a sheet of glass, then as carefully remove the tumbler from its metal coating, we can isolate the one from the other, without getting a discharge from either. If we now as carefully replace them, the whole can be discharged as before. If duplicates of the metal tumbler and the inner block be prepared, we may place the charged tumbler in the new coatings, and obtain a smart discharge from it, thus showing that the glass itself, rather than the tin-foil coats, receive and retain the charge.

Some very amusing experiments can be performed with a small Leyden jar, charged with electricity from an Electrophorus. One favourite with young persons, is that of giving and receiving shocks. In this instance, perhaps, the shocks are like donkey's kicks, more blessed to give than to receive; but they generally cause much fun on the part of both giver and receiver. As the employment of small jars of not over pint size is recommended here, we need not fear any bad consequences from taking the shock, but care should always be taken to avoid giving a shock to timid, delicate persons, and specially those suspected of being liable to fits, or affected

he must grasp the jar in one hand and present the knuckles of the other hand to the knob. If the jar is placed on a pane of glass, a sheet of vulcanite, ebonite, or gutta-percha, or an inverted glass tumbler, so as to insulate it from the earth, we may draw sparks from it in driblets, so to speak. That is to say, we may first draw a spark from the outer coating by presenting the knuckles or finger to it, then we can get a spark in like manner from the knob, then another from the outside, and so on, until all the charge is exhausted.

If a large jar is to be discharged, or if we wish to discharge the jar without receiving the



DESCRIPTION OF FIGURES.

- FIGS. 1, 2, AND 3.—FORMS OF GLASS BOTTLES WHICH MAY BE USED IN THE CONSTRUCTION OF LEYDEN JARS.  
 FIG. 4.—KNOB, STEM, AND CHAIN OF CONNECTING ROD.  
 FIG. 4a.—SUGGESTIVE FORM OF LINK FOR CHAIN.  
 FIG. 5.—ALTERNATE METHOD OF MAKING CONNECTING ROD.  
 FIG. 6.—BOTTLE LEYDEN JAR WITH BENT CONNECTOR.  
 FIG. 7.—MOST SIMPLE FORM OF LEYDEN JAR.  
 FIG. 8.—SPOTTED LEYDEN JAR.  
 FIG. 9.—DIAMOND SPECKLED LEYDEN JAR.  
 FIG. 10.—DISCHARGING TONGS.

with heart disease. The outside of a charged jar may be handled with impunity, and we may, therefore, take a charged jar in one hand, and present its knob to another person. The instant the person to whom it is presented touches the knob, or sometimes, indeed, before it is actually touched, a snappish spark leaps from the knob and flashes through the person to the earth, administering a smart electric shock to the nerves on its way. If several persons join hands around a charged jar, and the two persons at each end of the chain touch the jar—one touching the outer coating and the other the knob—the charge will leap through the whole chain and all will equally feel the shock. When one person wishes to give himself a shock,

shock ourselves, we must employ a pair of discharging tongs, such as those shown at Fig. 10. A simple and inexpensive pair may be made out of a piece of brass wire, passed through a piece of cork held in a glass tube. The ends of the wires should terminate in brass balls, similar to that forming the knob of a Leyden jar, or in small lead bullets. The ends of the wires may be bent around until the knobs touch the outer coat and the knob of the jar at the same time. If now one of the knobs is placed on the outer coating of a charged jar, and the other knob is presented to the knob on the jar, a sharp snap will be heard, and a spark will flash from the knob, showing that the jar is discharged. To use the tongs for discharging the jar through a



gas jet, etc., first place one of the knobs on the outer coating, hold the knob of the jar near the jet, and then bring the free knob of the tongs around to the other side of the jet, so as to discharge the jar through the gas as it issues from the burner.

An amusing and instructive experiment can be performed with a charged jar and a pinch of gunpowder. Place a few grains of gunpowder in a heap, on a piece of cardboard, and discharge the jar by means of the tongs through the heap of powder. The only effect observable will be a scattering of the grains, as by a jet of air. Collect the grains again into a heap, and lay across the heap a thread of wetted silk. Now charge the jar, and discharge it through the heap as before. This time the spark will fire the gunpowder, because the wet silken thread has detained the spark for a moment on its way to the outer coating. The phenomena of a thunderstorm may be practically illustrated in a simple manner, by means of a piece of home-made apparatus and a Leyden jar. Make a wooden stand of baked mahogany, 5 inches by 10 inches by  $\frac{3}{4}$  inch, and well varnish it. At each end fix glass pillars, about 7 inches high, each surmounted with a metal knob. Get two pieces of cardboard, cut them into irregular forms to resemble clouds, and paint them the colour of thunder clouds. In each piece insert a piece of wire, or paste a thin strip of tin-foil across the two pieces in such a manner as to bring the two ends of the strips in a line with each other lengthwise of the clouds. String the clouds on a thread of silk and fasten the two ends to the two glass pillars near their tops. Connect each cloud with the metal knob nearest it, by means of a flexible metallic thread, such as the tinsel thread sold by lacemen. To the lower edges of each cloud connect a thread of silk some 18 inches or more in length. When all has been completed, connect the outer coating of a charged Leyden jar, by means of a flexible metallic cord, with one of the metal knobs on one of the pillars. Then place the jar on a pane of glass, or other insulating substance, and connect its knob by means of another length of flexible metal cord, with the knob of the opposite glass pillar.

Now draw the clouds toward each other by means of the silken strings attached to them, and when they are within striking distance of each other, a spark will leap from one cloud to another with a sharp snap, thus illustrating how the lightning leaps from one cloud to another in a thunderstorm.

The passage of the celestial electric spark from the charged thunder cloud to the earth may be illustrated by means of a toy house, loosely put together and held in place by bits of wire, under one of the clouds on the stand. The wood of this house should be very light, and the wires so disposed as to cause breaks at the joints of the pieces composing the house. In leaping across these breaks, the spark will disturb the joints and cause the house to fall to pieces. A toy lightning-conductor should be placed at one end of the ridge, and this should be connected to one of the short wires in the house itself. One of the wires near the bottom of the house must be connected by means of the flexible metal cord taken from one of the clouds, to the outer coating of the charged jar, instead of from the cloud to the jar, and the other cloud to the knob of the jar. If now we pull along the cloud until it is within striking distance of the toy lightning-conductor, the spark will leap from the cloud to it, and from it to the loose bits of wire in the house, displacing them and knocking the whole thing to pieces. This shows us that the lightning-conductor on a building must be connected with a good continuous conductor reaching from it right down into the earth.

A similar effect on a toy ship may be shown, if the mast of the ship is loosely jointed, and the ship made to swim in a metal tray under the clouds, the tray being connected to the outer coating of the jar. A shallow dish of any kind may be substituted, if the dish is coated with tin-foil.

These are only a few experiments out of the many which may be conceived by the exercise of a little ingenuity. Want of space, however, prevents me from giving any more here. The performance of experiments with the Leyden jar and similar condensers, may be greatly facilitated by using a Wimshurst machine, instead of an Electrophorus, to generate the electricity.

## A FOLDING EASEL.

By ELECTRON.

**T**HIS easel will be found very useful, either for indoor work or outside sketching. It will fold into a space of 3 feet 2 inches long and  $2\frac{1}{2}$  inches square, and can thus be easily carried. Fig. 1 is a

front elevation, showing the easel set up; Fig. 2 shows the joints at the top, and Fig. 3 the joint in the legs.

Procure six pieces of mahogany, each 2 feet 10 inches long,  $1\frac{1}{4}$  inches broad, and  $\frac{3}{8}$  inch thick; plane up these square, and cut the ends of three semicircular at both ends, and the remaining three semicircular at one end. The lower ends

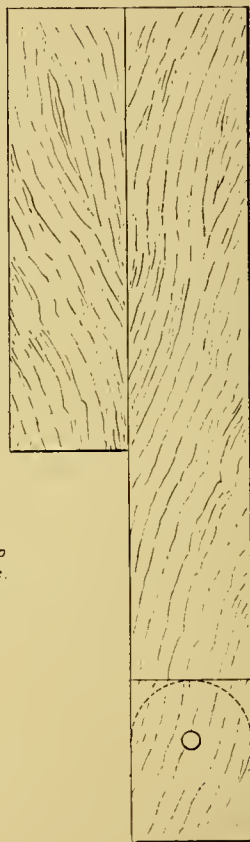
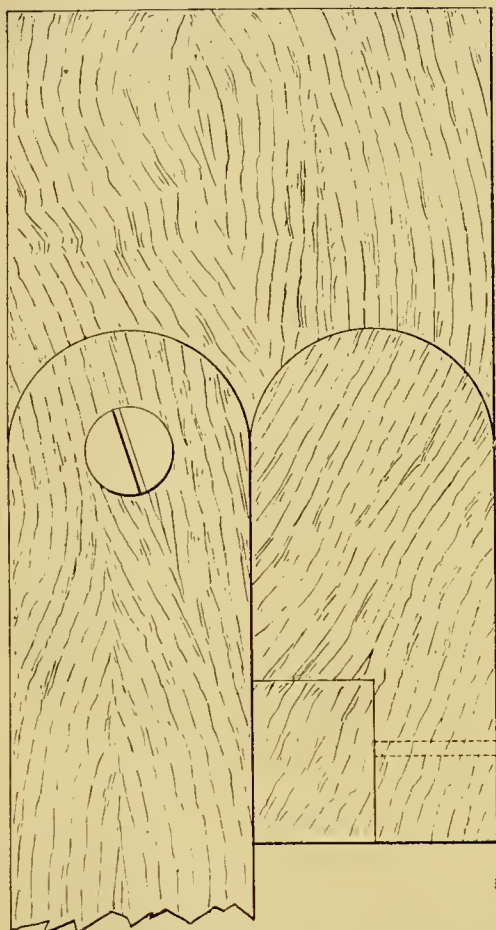
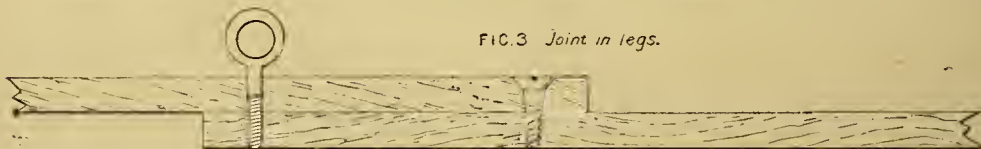


FIG. 2.  
Joint at top  
Full size.



FIG. 3 Joint in legs.



of the last three must be sloped down to  $\frac{1}{2}$  inch diameter, as shown in Fig. 1, and fix in the ends of each the pointed end of a wire nail  $\frac{3}{16}$  inch diameter and  $1\frac{1}{2}$  inches long, allowing the nails to project  $\frac{3}{4}$  inch, to form spikes to keep the lower end firm when set up; screw each pair of legs together with a thick screw  $1\frac{1}{8}$  inches long, as shown in Fig. 3, the screw being  $3\frac{3}{4}$  inches from the end of the upper leg; the screw heads must be countersunk, so as to be flush with the face of leg; also, bore another hole about  $3\frac{1}{8}$

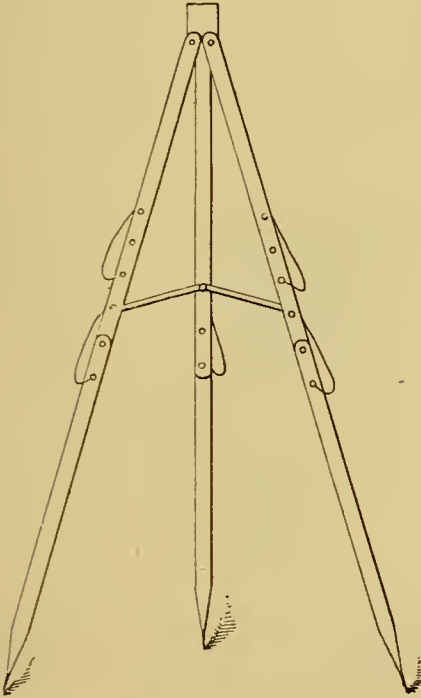


FIG. 1.—FRONT ELEVATION OF EASEL.

inches from the screw, and fix in it a pin made of brass rod  $\frac{1}{8}$  inch diameter, with a ring formed on the end, and the shank tapped to screw in. These pins should be made to screw in tight. Fig. 3 shows the pin in position. The top joint is shown full size in Fig. 2, and is made in two pieces. Cut two semicircular openings in the lower end of the front piece; these can be cut by a centre-bit. The back piece has a recess  $1\frac{1}{4}$  inches wide cut in it, and is fixed to the front piece by glue and screws. Fix the two front legs in the semicircular openings, with a screw,

as shown, countersinking the heads. The back leg is made semicircular, as shown by the dotted lines, and fixed in the recess by a pin  $\frac{1}{8}$  inch diameter.

Fix to the inside of the two front legs two pieces of brass plate 6 inches long and  $\frac{1}{2}$  inch wide, riveted together in the centre, and fixed to each leg by a screw. The joints of this piece of brass must be stiff, so as to hold the legs at any distance apart, and will fold upwards when the legs are folded together. See Fig. 1.

Also screw into the back of the two front legs two brass eyes, which must be kept to the outside edge, so as to clear the back leg when folded, and fix in these eyes a piece of brass rod  $\frac{1}{8}$  inch diameter, with an eye formed at one end, and the other end turned down at right angles. These rods may be 1 foot or more in length, depending on the distance between the legs when open. The ends fit into two brass eyes screwed into the edge of the back leg, and keep the whole firm when set up.

Bore eight holes in the upper part of the front legs, for the pegs, to support canvas, and make two pegs of brass rod  $\frac{3}{16}$  inch diameter, with an eye formed at one end; taper the points of the pegs a little, to enter the holes more easily, making them about 2 inches long, and sew to each peg a piece of elastic 1 foot long, and fix the other end to the outside of each leg by a tack; also, sew to each pin a piece of elastic 1 foot long, and fix the other end of the elastic to the edge of the legs by a tack, as shown in Fig. 1. To fold the easel, unscrew the pins, and turn the lower part of each leg upwards, and fold the back leg inwards; also fold the upper part of the two front legs together, allowing the two pieces of brass to fold upwards. The pieces of elastic will prevent the pins and pegs from being lost, and they can be brought into the centre; also turn the two brass rods upwards, and fix the whole together with a strap, when it can be carried easily. The wood may be varnished or polished to improve its appearance, and if used for outdoor work, the varnish will have the additional advantage of preserving the wood in case of an accidental wetting.



# OBJECTGRAPHY : A NOVEL PROCESS OF DESIGNING PATTERNS FOR FRETWORK INLAYING, ETC.

By DONALD BEDE.

**I**F any amateur has ever attempted the production of a design, however simple, by the ordinary method of drawing, he will have discovered that the work requires the exercise of considerable skill, and further, that if the outline drawing is to be used as a pattern for the reproduction of the same in the form of finished work, it must be executed with skilful accuracy in every particular, requirements which are frequently outside the capabilities of the average amateur. Knowing and feeling this, and knowing, also, the greatly enhanced pleasure that is felt in the making up of a design which is one's own arrangement, I submit the details of this process to the readers of this Magazine, with the pleasure which is derived by anticipation, from the belief that everyone who tries it will be both successful and delighted with the result.

The method, briefly put, is that of taking existing forms and shapes, such as leaves and flowers, scraps, sea-weed, etc., arranging them together in various styles—as fancy may suggest—taking a sun-print from them upon sensitized paper, and thus obtain an outline pattern. It

will be seen at once that, however little skill the operator may possess as a draughtsman, he can produce such a variety of the most beautiful outlines from the leaves alone of different plants and trees as will probably surprise him.

Fig. 1 is a cabinet photo frame made by the writer, in which the leaves of the chrysanthemum form the outline; any other kind of leaf would, of course, answer a similar purpose. The method of procedure is as follows: First prepare the sensitized paper, or purchase

one of several kinds which are in the market, such as the Ferro prussiate paper, commonly known as the Blue process; another, which gives a black tone in the unexposed portions, sold by Messrs. Bemrose and Sons, of *Old Bailey*, etc., etc. The writer prefers to make up his own; for this purpose some common white tea-paper, as used by grocers, will do very well; cut this up into

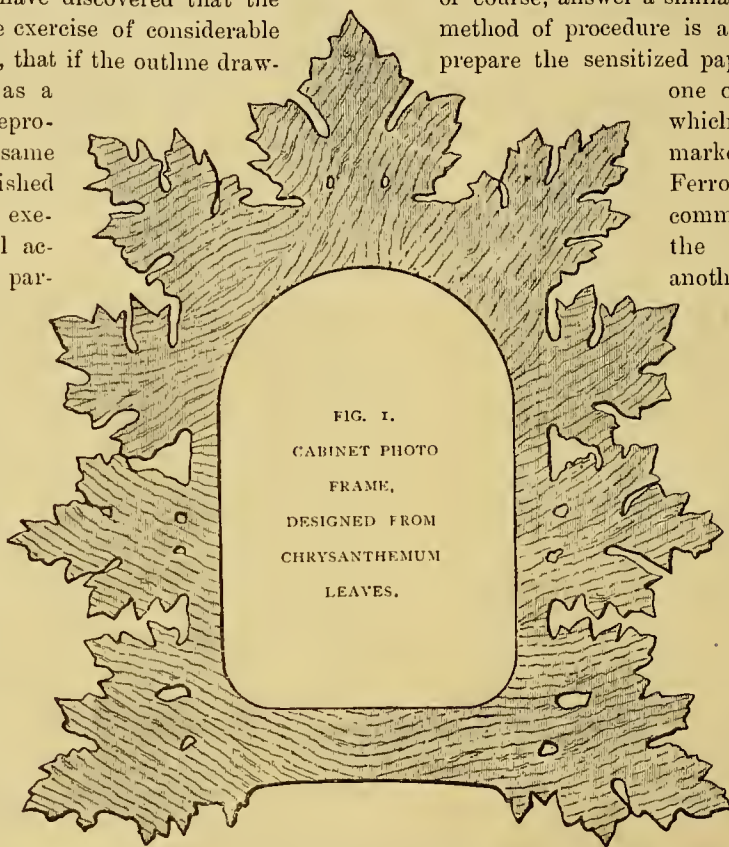


FIG. 1.  
CABINET PHOTO  
FRAME,  
DESIGNED FROM  
CHRYSANTHEMUM  
LEAVES.

convenient sized pieces, and sensitize one side of the paper by "floating" it, that is, passing it on and over the surface of a solution of nitrate of silver in water, about 12 grains of silver to 1 ounce of water; the more silver is used the deeper the colour obtained, and, of course, the more sensitive the paper. A flat dish is a convenient vessel in which to use the solution. Before wetting the paper, make pencil marks from corner to corner upon the side to be sensitized. As each piece of paper is drawn over

the solution hold it up to drain, and hang up to dry in the dark or where no strong light can reach them; when dry, they are ready for use. Suppose you wish to produce a similar article to Fig. 1: Take an ordinary picture frame with a glass front, take out the back, and provide one sufficiently stout to withstand the pressure of

the sensitized face next the leaves, lay over this a few thicknesses of newspaper sufficient to keep the whole tight when the back is buttoned down; next expose the frame to the sunlight until the paper becomes a deep brown; take out the paper and you will find a sharply defined white pattern upon a dark ground, ready to be

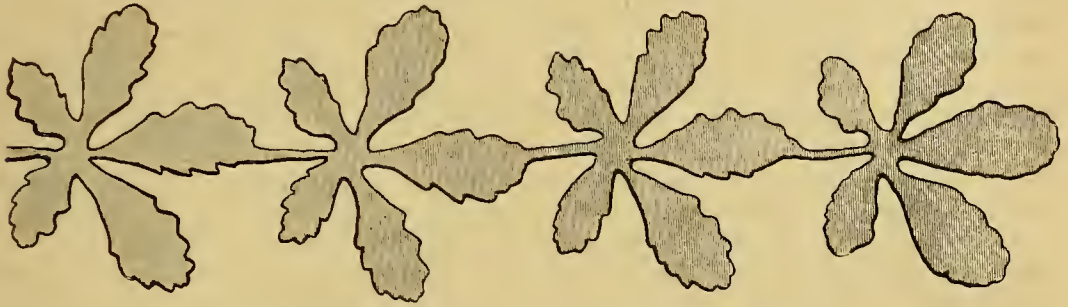


FIG. 2.—BORDER OF "CREEPING TOM O' TH' HEDGE."

being buttoned down; the sides of the frame should be fitted with buttons which will hold the back into its place, one on each for a small frame, more for large ones. Take an ordinary cabinet photo card, and mark a straight line from top to bottom in the centre, pick some chrysanthemum leaves of various sizes and arrange them as shown in Fig. 1; the complete frame may be done in this way, but if it be desired that the frame shall be alike on both sides, then the leaves

must be arranged only on one side and up to and on the centre line of card. One copy taken from the leaves and a reversed one from the cut out, stuck together and used as one; this because no two leaves in all the world of nature are alike—what an endless variety!

Having arranged the leaves to your fancy, lay over them a piece of sensitized paper with

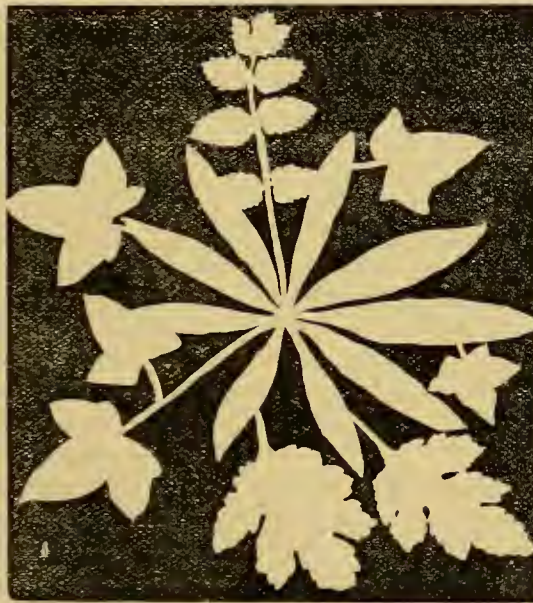


FIG. 3.—COMBINATION OF VARIOUS LEAVES.

pasted upon a piece of wood, etc., and cut out. If the pattern is to be used at once nothing need be done to it, but if it is to be kept for any length of time it must be "fixed," by immersing it in a solution of hypo-sulphate of soda and water (1 ounce of soda to 8 ounces of water) for about ten minutes, afterwards washing in clean water for half an hour. An oval, cushion, or other shaped opening is then cut in the centre; having cut the first one out you can use

it instead of the leaves with sensitized paper, and produce as many fac-simile copies as may be desired. The writer prefers to make all first patterns in thin sheet zinc, which are very handy indeed for reproduction. Fig. 1 was made from one piece of wood; of course, the leaves could have been arranged just as well in lengths to suit any size frames, cut up and mitred at the



corners, the joints being hidden by gluing a complete leaf over each; preferably, cut out of a different coloured wood. Fig. 1 is intended as a stand frame, so that in addition to the back to hold, the photo should be provided with a hinged leg behind. The effect of the fretwork may be much improved by scoring in upon each leaf the appearance of the veins, of which the original is close at hand. The particular leaf is given merely as a suggestion to the reader, as the whole vegetable kingdom lies before him from which to select. Another very pretty and bold leaf is the vine, the ivy, the lupin, etc., even the weeds in the hedgerows affording some very pretty and effective patterns; nor need the designs so produced be used solely for fretwork frames; delicate and beautiful panels for small cabinets, freizes, overmantels, brackets, clock-cases, borders, dados, stencil-plates, etc., may be readily arranged.

Fig. 2 illustrates a border of "Creeping Tom o' th' hedge." A spray of ivy may be used for semi-inlaying for a panel; the design being in one piece, is cut clean out of the wood, stained, and afterwards put back into its place—but not quite home, leaving a raised portion on the surface. This kind of work is rapidly executed, and has all the appearance of simple carving. Fig. 3 illustrates the combination of various leaves to be enclosed in such lines as the reader may desire; the process may also be most usefully employed in the production of repoussé work, and will be found an easy and delightful task.

In conclusion, permit me to say that I am not aware that the method herein described has been used for this purpose before, and that I have purposely abstained from giving any elaborate designs, desiring rather to give the reader the most elementary object lesson, and to lead the amateur on to help himself to the wealth of beautiful forms with which nature teems. I sincerely hope that the method may be found useful to very many readers, and, should further explanations be asked for, they will be promptly given.

I should also be pleased to hear of the success of any who attempt this work.

## SASH-MAKING.

By FAUST.

### III.—HUNG SASHES.

N the last article the mode of constructing an ordinary fixed sash, or "deadlight," was shown; that is the simplest form of window to make, and forms a capital lesson to the beginner, as those who have tried their hand at, and succeeded in making the framing there described, have advanced a considerable way in the art and mystery of sash-making, and will find their further lessons much simplified, now that they have mastered the mitreing and fitting of the sash mouldings and cross-bars.

The style of window to be treated of in this paper is what is termed in the trade a double-hung window. I shall first describe how to make the cases for a stone building, and then show some of the modifications that have to be made in their construction to suit the window openings of brick houses; first premising that the general construction of all is alike, but the minor details differ according to the style of building, or the part of the country where the work is done. I may remark here that in different localities even the names of the various parts of the framing differ; thus I have known the "parting rod" designated as the "parting bead," "dividing bead," "middle rod," "centre bead," and "doubler," the sense of the latter term I never could see; the same remarks apply to different kinds of carpentry, as technical terms vary with the district. I shall, however, endeavour to use the most generally used names for the various parts of the work, and trust that a reference to the accompanying drawings will make all clear.

We will suppose that we have to make a window to fit an opening, the "daylight" of which (that is, the exact size of the actual aperture, exclusive of any rabbets) is 7 feet by 3 feet; this window, when finished, will present the appearance shown in Fig. 12.

The material used should be the best red, or pitchpine, and we require for the window-case the following pieces (the sizes allow for working,



the exact measurements will be given when we come to their preparation), one sole, 4 feet 3 inches by  $7\frac{1}{2}$  inches by 4 inches at one edge, bevelled down to  $1\frac{3}{4}$  inches at the other; Fig. 13 shows a section of this piece in the rough, it is kept ready-cut in most woodyards; two pulley stiles, as the side pieces of the case are called, 7 feet by  $5\frac{3}{4}$  inches by 1 inch; one lintel, 4 feet 3 inches by  $6\frac{3}{4}$  inches by  $1\frac{1}{2}$  inches; two inside facings, 7 feet 3 inches by  $6\frac{3}{4}$  inches by  $\frac{7}{8}$  inch (these may be of yellow pine); two outside facings, 7 feet 3 inches by  $2\frac{1}{2}$  inches by  $\frac{5}{8}$  inch; one ditto for lintel, 3 feet 2 inches by  $2\frac{1}{2}$  inches by  $\frac{5}{8}$  inch; and one board of clean yellow pine, free from knots, 7 feet by 10 inches by  $\frac{5}{8}$  inch, to work the batten rods and parting beads out of. This is all the material required for the case, the wood for the sashes we will speak of later on, as the sizes for it can be easily got from the case. Fig. 14 is a section of the side of the case, and a reference to it will show at a glance the position and names of the various pieces.

Having procured the wood we can now proceed to make our case; but, first, let us make a mould for the sole. It can certainly be made without a mould, but having a mould tends to insure accuracy, and if more than one case is being made, secures uniformity and simplifies the fitting of the sashes. A reference to Fig. 15 will show the shape of the finished sole. A little explanation may be required as to the use of the grooves shown; the one at the bottom of the sole is intended to cause the case to grip on the lime or cement with which it is bedded into its place, and also to prevent any water being driven under the sole during heavy winds; the groove in the front of the sole, near the bottom, is for the reception of the back edge of the piece of wood which finishes the window-breast on the inside to go into, and so make a neat and tight joint. The smaller grooves or hollows which are seen at the breaks on the upper surface of the sole, are to prevent rain being driven up under the bottom of the sash into the house, a thing we often find, especially in the country, or at the sea-side, where strong winds are frequent.

Having prepared the sole, let us take the pulley stiles; plane them up on one side and both edges, gauging them to exactly  $5\frac{1}{2}$  inches wide. Next, take the inside facings, plane up the best side and one edge, turn them over on the bench, and take just one long shaving off the back, next to the planed edge, this is to let the facing lie close to the pulley stile when nailed on. Now plane up the lintel, making it  $6\frac{3}{8}$  inches wide. The outside facings must be planed on *both* sides, and a  $\frac{5}{8}$  inch bead run on one edge, leaving the other edge rough.

Now we are ready for the more intricate part of our job, and must give the work all our attention. I have not said anything about marking the face and edge of each piece of wood, as I presume that the advanced worker who attempts windows knows that he should never neglect it if he seeks to do good work; to the careless, I would say always mark your face and edge, that is, the best and first planed-up surfaces of the wood, and work all your gauges, and do your squaring off them, and you will find your work much more accurate and tradesmanlike than if you neglect this "important trifle." I may be the more excused from urging this matter on my carpenter friends, as I have seen many otherwise fair pieces of framing distorted and twisted through gauging and squaring at random off either side or edge that came handiest.

Put a  $\frac{1}{16}$  inch iron into a plough, and set it to make a groove exactly  $2\frac{1}{4}$  inches from the edge of the pulley stile, this groove should be  $\frac{1}{4}$  inch deep, and must be worked off the *back* edge of the stile. Groove the lintel in the same way (Fig. 17a). Now "set out" your case. Place the sole on the bench before you, mark off the width of your "daylight," that is 3 feet, making it fall in the centre of the sole, so as to leave an equal space at each end; square your marks across, and down the edges, then make other marks  $1\frac{1}{2}$  inches nearer the ends of the sole, do not square them across, but give them an angle, say, of  $\frac{1}{4}$  inch outwards, then set a marking-gauge to 1 inch, run it from the underside of the sole, cut down your marks with a sharp saw, and remove the piece with a chisel, your sole will now present the appearance shown

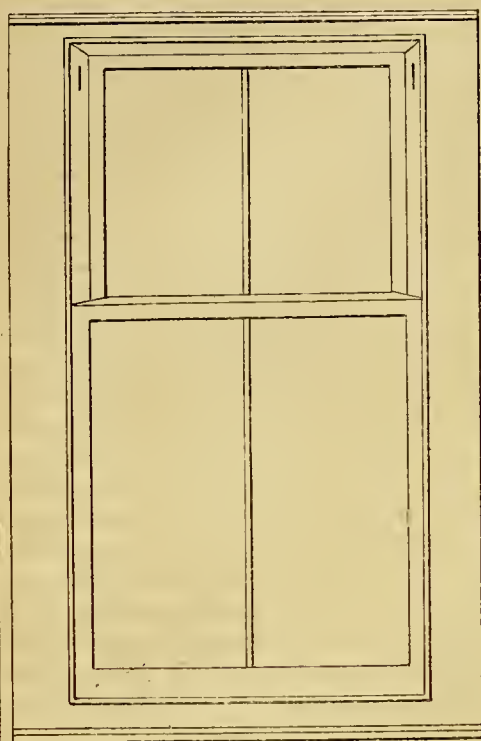


FIG. 12.

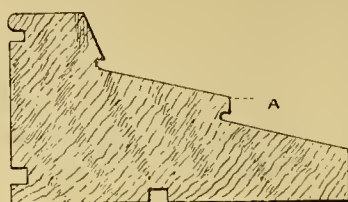


FIG. 15.



FIG. 20.



FIG. 17a

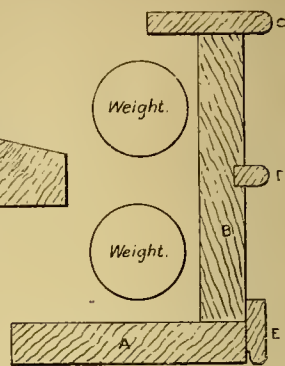


FIG. 14.

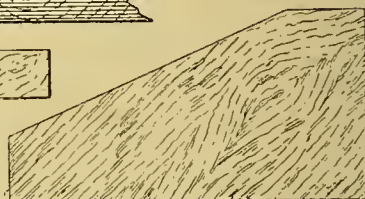


FIG. 13.

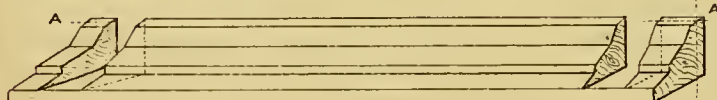


FIG. 16

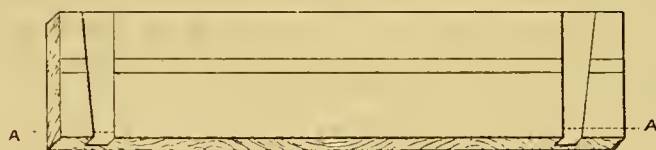


FIG. 17.

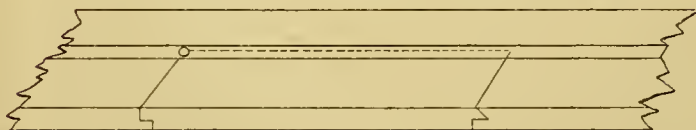


FIG. 18.

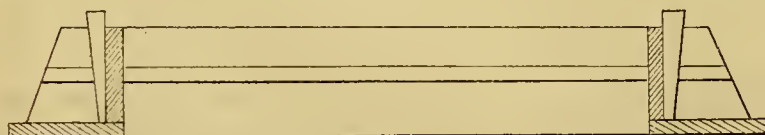


FIG. 19.

## DESCRIPTION OF FIGURES.

FIG. 12.—DOUBLE HUNG WINDOW, WITH CASE.

FIG. 13.—SECTION OF CASE SOLE IN THE ROUGH.

FIG. 14.—SECTION OF SIDE OF CASE.

A, INSIDE FACING.

B, PULLEY STILE.

C, OUTSIDE FACING.

D, PARTING BEAD.

E, BATTEN ROD.

FIG. 15.—SECTION OF CASE, SOLE FINISHED.

FIG. 16.—FINISHED SOLE, SHOWING CUTS FOR RECEPTION OF PULLEY STILES.

FIG. 17.—FINISHED LINTEL, DOTTED LINES, A, A, SHOW WHERE TO CUT AWAY FOR INSIDE FACING.

FIG. 17a.—SECTION OF LINTEL.

FIG. 18.—PART OF PULLEY STILE, SHOWING CUTS FOR POCKET.

FIG. 19.—MOPE OF WEDGING CASE TOGETHER.

FIG. 20.—MITREING OF BATTEN RODS.

in Fig. 16; cut away the thickness of the inside facing from the inner edge of the sole, as shown by the dotted lines at A. Lay the lintel on the sole and mark off your cuts, then proceed as with the sole, but only making the grooves  $\frac{1}{2}$  inch deep. Cut the pulley stiles to 6 feet  $11\frac{1}{2}$  inches, lay them side by side, and mark them across with a square, 1 foot from the bottom end, and again 2 feet from the first mark; make these marks only across the part of the stile that is on the wide side of the groove, that is, towards the front edge of it. Bore a  $\frac{3}{8}$  inch hole in the groove where the marks terminate, and with a compass, or port saw, cut down the centre of the groove between the marks, then, with a fine dovetail saw, cut across the stile in the manner shown in Fig. 18; cut only half-way through the wood, turn the stile up, and cut half-way through from the back, but  $\frac{1}{2}$  inch nearer the top of the stile, Fig. 18 should make this clear to you; do not break out these pieces of the stile at present. When your case is put together and you are proceeding to fit in your parting beads, you can give the pieces a smart tap at the back near the lower end, this will knock them out, replace them, and the bead will keep them in position. These form the "pockets," and are the means whereby the weights are introduced into the aperture behind the case when in position.

Now you require four sash pulleys. They may be had at any ironmongers, and at all prices; I should, however, advise those with brass wheels and brass covered face, as they stand very much better than the enamelled or china faced ones; of course, if you intend to put heavy plate-glass into your sashes, they will have to be hung with chain, and in that case suitable pulleys must be purchased. Sink these pulleys flush with the surface of the stiles, about 6 inches from the top ends, and in the centre of the part where the sashes run, two in each stile; the mode of sinking will make itself apparent from their shape. Cut out the apertures neatly, and see that they fit rather tight, or the working of the sashes will tend to loosen them. Before finally screwing the pulleys in their place, clean off the face of the stile with a fine hand plane.

The batten rods and parting beads now claim our attention. Take the board of wood laid aside for the purpose, plane up one side, place it in the bench screw with the planed side next you, and run a  $\frac{5}{8}$  inch bead on the edge, set a gauge to  $1\frac{1}{2}$  inches, run it along the edge, and rip off the piece, lay it aside, and make another. Then make the parting beads in the same way, but  $\frac{7}{8}$  inch wide, and a piece of each, 3 feet long, for the lintel. If you possess a cutting-gauge, you can run it along both sides of the board before running the bead, and afterwards break the piece off with your fingers; of course, if you have not a cutting-gauge you must rip them off with a saw after the bead is run, as described.

Take the inside facings, nail them on to the inside edge of the pulley stiles, letting them project equally at each end; be careful not to put any nails into the "pocket," or you will have a deal of trouble with it when you come to hang your sashes. With a fine plane remove any over-wood along the joint, and the case is ready for putting together.

Take two pieces of wood about a foot longer than the width of the case and about 6 inches wide, lay them across the bench, or a pair of trestles; lay the stiles on them with the facing down; put the sole and lintel into their places; fit four wedges into the cuts in the sole and lintel, drive them firmly home, and also put three or four nails through sole and lintel into the ends of the stiles, and a small nail into each of the wedges to keep them in place (see Fig. 19); cut off the ends of the wedges and put on the outside facings, mitreing them at the corners, and allowing them to project over the case  $\frac{3}{4}$  inch. Then cut off the projecting ends of sole and lintel on the bevel, somewhat in the style shown in Fig. 19. This is to allow of the case fitting into the rabbet of the stonework; the cut should be from the outer edge of the outside facing, slanting outwards to the outer edge of the inside facing.

Now turn the case over, nail down the ends of the inside facings to the sole and lintel; plane up the face of the case with a fine plane, and then fit in the parting beads. Put the bead



into the groove in the lintel, keeping it long enough to go into the side grooves, nail it in its place with fine brads; fit the side beads at the bottom end with a small tenon to slip into the hole in the end of the sole (which is formed by the groove in the stile passing the end of the sole), cut them to the proper length, and fit the top ends to the lintel bead with a gouge, keep them a nice tight fit, neither too long or too short; but do *not* nail them in the groove, they should be just tight enough to remain firmly in their place, so as to allow of being taken out when required to hang the sashes or get at the weights. Take the batten rod for the lintel, strip it up to a sufficient width, just what will allow for the thickness of the sash, mitre the ends, as shown in Fig. 20; do not strip the side pieces to a width at present, mitre the ends into lintel and sole (Fig. 20), place them in position, and drive a nail into the centre of each; only putting it in half-way, however, so as to admit of its being easily withdrawn when fitting the sashes.

## HOW TO MAKE A CANVAS BOAT OR CANOE.

By JNO. H. MILNE.

(For Illustrations, see Folding Sheet issued with this Part.)



HE designs and modes of construction of canoes are very numerous, depending, of course, on the work for which the vessels are intended, a fragile canoe for an inland stream being unsuitable for the sea or a choppy river. Some canoeists prefer the most delicate craft, and sit like the renowned Blondin, with the balance-pole exchanged for a paddle, in momentary jeopardy of a quick movement which may precipitate them headfirst into the water. Others prefer more room and liberty of movement, with perhaps the option of the sail instead of the paddle.

Although some attain great dexterity in handling the narrowest and frailest of vessels of this class, yet a canoe is obviously none of the safest of craft, and it is most unwise for anyone to choose this class of boat unless he is a good swimmer. Dangers are so constantly present, accidents so easily occur, men lose their

presence of mind, and, whether by a thoughtless movement, the boat is overturned, or upset by a collision, when once in the water, if the boatman who cannot swim has only himself to rely on, there is little chance of rescue even in a narrow river, especially when the movements of the person are interfered with by wet clothes, or by being entangled with the boat.

Therefore, before entering upon the practical part of this article, it seems highly advisable to suggest to the reader the above precaution, and next to the swimming accomplishment, that the canoe he uses should have a fair amount of steadiness, even at the sacrifice of speed.

With the object of combining all as far as possible, a canoe, as represented by the drawing, A, will be found to be durable if well made, and to be light, buoyant, and steady. It is specially designed to make the construction as easy, and the cost as light, as possible.

A drawing of a lighter boat, suitable for smoother water, is also given, if the reader should be disposed to prefer it.

*The Keel.*—Procure a piece of well-seasoned strong wood, say, ash, 10 feet long; plane it, so that when dressed it will be  $1\frac{3}{4}$  inches deep, and 1 inch, as given, or  $\frac{3}{4}$  inch, thick. If soft wood is chosen, although not so good, but slightly cheaper and more easily worked, the depth will require to be greater, at least 2 to  $2\frac{1}{2}$  inches.

*The Stems.*—Two pieces of wood will be required for the stem and stern, or both stems, 1 inch or  $\frac{3}{4}$  inch thick by 2 inches broad. Be sure the wood is well-seasoned, quite solid, and free from cracks, otherwise it will be useless. After being planed up, the stems must be fixed to the keel, in the manner shown later on. Notice that the bows are curved. This is done principally to give the boat a neater appearance, but is not essential.

This done, the stems will be required to be fixed to the keel. Place the stem on the keel at right angles, see Fig. 1, marking where they overlie, or measure them off, and cut the two pieces so as to fit in flush with each other. They are screwed firmly together at A, A, Fig. 1; the corner can then be rounded off. The mode of fitting and screwing together is given in

Fig. 3; *v*, Fig. 1, is an angle iron; a curved iron can be inserted on the rounded part. The piece, *a*, *a*, can be 2, 3, or 4 inches, as the reader prefers. Then cut another piece, represented by the dotted line, so as to fit flush with these.

*The Divisions or Compartments.*—It will be noticed in Plan A, two divisions, *d* and *d*. These are made of three pieces of soft wood,  $\frac{3}{8}$  or  $\frac{1}{2}$  in. thick (see Plan C, cross section), triangular shaped, two sides fixed to the gunwales, the other fitted on to the keel. The pieces overlap each other and are firmly screwed together; the outer sides are curved into the shape the boat will assume, see Plan C, the upper part, *d*, representing the turtleback in Plan A.

These divisions are a help to the amateur, as they enable him to get the shape of the boat with considerable ease, while they also stiffen the framework of the boat where most required; they will be 6 inches at the broadest part. If this is considered too heavy, the support may be narrowed by curving it, as in the dotted line. It will be noticed that only two are drawn in Plan A, while there are four given in Plan B. The boat in Plan A is intended to have two divisions. If it should be intended to have four, a division can be substituted for the second rib from the two stems. Plan B, *d*, *d*, shows the position of the divisions nearest the stems, if four divisions are intended. The divisions can be made of solid board, if preferred,  $\frac{1}{4}$  inch, with a slight cross-piece to prevent warping and splitting; but this will add to the weight of the boat.

The reader can, on the other hand, make one division amidships, although it may be more inconvenient, in which case the dimensions will be as in cross section *c*, but broader, Plan C representing the divisions at *d*, in Plans A and B. The cross section gives the manner of fixing. If he has two they will be as in Plan C.

Keel and stems being in position with the divisions firmly fixed, the shape of the boat will easily have been obtained. It only follows now to put the ribs in position.

*Making of the Ribs.*—Procure from any cooper some ordinary barrel hoops. These can be bought for a few pence. Their width runs from

1 inch to  $1\frac{1}{2}$  inches; 1 inch will do very well. Soak them in water till they are pliable, and can be easily bent into the required form. The preferable plan is for the vertical ribs to underlie the keel, for they are thus less exposed to injury from within the boat by being protected by the keel, they being protected from injury on the outside by the strip of wood nailed on the keel, hereafter mentioned. Also to let the ribs be flush with the bottom of the keel, *a*. This will be seen on referring to the Plan A, also the number of the ribs, which will be found to be thirteen.

Cut, as indicated in the plan, spaces in the underpart of the keel just sufficient to let in the ribs. Now they can be screwed from the bottom to the keel, or if the reader prefer, he can obtain neat bolts, and bolt them from the underside, screwing them from the upper part of the keel.

All the ribs having been firmly screwed into position, after having been rendered pliable, it will be necessary to fix in the longitudinal ribs and gunwale.

The longitudinal rib, *e*, is screwed to the stem, the end being cut off at an angle so as to fit neatly on the stems; this is then screwed in position. It is also screwed or nailed to the divisions and to the other stem, as shown in Plan A. It will be noticed that this rib passes inside of the vertical ribs, and that there is a fall of 1 inch amidships, giving a spring from stem to stem. This latter is principally to give an improved appearance to the boat.

In order to fasten the longitudinal rib to the vertical ribs the reader is recommended to proceed thus. Pass strong tarred string, or, as seafaring men call it, "marline," supplied by ship chandlers, across the two pieces, first in one direction several times, then across the opposite way, and so on until a firm joint is made; then tie the ends; this will give a strong joint when painted. Proceed in like manner with all the ribs.

The ordinary cask hoops are round on one side and flat on the other. They can be planed and trimmed, so as to make them flat, or flat hoops can be procured. If the hoops are not long enough for longitudinal ribs, they can be jointed.

The gunwales come next. Procure a piece of ash, about  $\frac{1}{4}$  inch thick, or, if the reader prefer, he can say  $\frac{1}{2}$  inch, which will be stronger though heavier, and 1 inch broad; screw this to one stem, and fix each rib and division to it, ending by screwing it to the other stem. The other side is done in the same way. A piece of wood, *n*, is let into each division at the centre of *D*, Plans A and B, and passed to the stems, where it is fixed. This is to form the support for the canvas in making the turtleback. A piece of wood, *k*, *k*, about 1 inch deep and  $\frac{3}{8}$  or  $\frac{1}{2}$  in. thick, is screwed on to the flat piece, *L*, *L*, or deck, Plan B, which is fixed to the divisions and the gunwale. The narrow ridge, *k*, tends to prevent water running into the well. The frame can now be painted.

A few suggestions may be here given for the consideration of the reader. Small light brass angles can be used to fasten the divisions to the keel, also to the gunwale, and a small strip of brass can cover the joining where the keel meets the stems. Iron will do, although its rust is injurious; but the irons can be painted or tarred. The boat can be slightly lightened, if wished, by simply adopting the ash keel, and making the stems of barrel hoops, as in Fig. 4, screwed to the keel and fixed in position.

On the other hand, if the reader finds he cannot make the joints where the gunwale and longitudinal ribs meet the stems strong enough, he can screw on to the stem from gunwale to keel a piece of wood shaped like Fig. 5, *B*, which is called an "apron," and gives additional foundation for the longitudinal ribs to be fixed to the stems. Fig. 5, *A*, stem; *B*, apron. If the edges are planed off as in the dotted line the ribs will lie flatter.

The canvas will now require to be considered.

There are different qualities of canvas in use which are known by the numbers they bear, No. 1 being the coarsest, No. 6 the finest, after which comes "duck" canvas of various kinds. For the purposes of the canoe, No. 4 would be suitable. The breadth of the canvas will be 2 feet, and will be put on not lengthways, but across the boat, so various pieces will require to be sewn together.

The following plan may be followed in putting the canvas on the frame. If the reader attempts to tack the canvas on to the boat, owing to the curves, he will find that ridges occur. Let him lightly tack on a length of canvas, beginning amidships, and sewing two breadths together, which will make 4 feet (or allowing for the seams causing a little overlying, an inch less), the distance between the divisions, and stretching the canvas so that it fits evenly, then wet it and allow it to shrink, which it may do considerably, pulling out the tacks. If the canvas had been firmly tacked it might have been torn or damaged. When it is dry, it will be found to be slack, and this can be drawn in. After the two breadths are stretched, let him sew the remaining necessary breadths together, having wet and stretched them as before, then, finally sewing all together, the complete canvas covering should be fitted on the boat. He can now take the canvas and stretch it into position, so that no ridges will occur. Then tack on the canvas over the gunwale, and the parts, *L*, *L*, and *k*, *k*, and fasten inside. The canvas will be found to be evenly stretched on the frame. After the canvas has been wet and retightened, as described, and finally tacked down or sewn to the ribs, it must not be wet, but painted; if wet again it may lose its shape and have to be retightened.

There are two kinds of seams which may be used: the "flat seam," which will be the neatest, or the "flat and round seam," as in Fig. 6, *A*, flat; *B*, flat and round. Two rows of stitches, one at each edge, will be put in. The seams must be turned over, and nailed on to the stems with copper broad-headed nails like large tacks, and also nailed to the divisions and keel. It is sewn round the ribs. It is, of course, drawn tightly over the gunwales, and nailed or sewn if wished.

Separate pieces should be made for the turtleback. The shape can be got by lightly tacking two pieces to the gunwale and letting them meet in the middle, and after getting the size, sewing them together, or by fitting one piece and sewing on at the side a small piece if deficient. The seam will then run from stem to



division on the top of the wooden support, H, Plans A and B. The canvas must then be stretched and nailed to the gunwale with copper nails.

It would be advisable, if the reader does not object to a little expense, to obtain the assistance of a sail-maker in manipulating, and especially in sewing, the canvas.

As a finish, and as a protection to the side of the boat, also to cover the joining of the turtleback canvas and the main canvas, a narrow strip of either flat or round hoop, with the flat side next to the boat, or a piece of ash, 1 inch broad and  $\frac{1}{4}$  inch thick, should be fastened to the gunwale outside, and run the whole length of the boat. It will cover the joining of the canvas of the upper deck and turtleback. \*J, J, shows gunwales both inside and outside.

A piece of flat ash, G, G,  $\frac{1}{2}$  inch thick, 1 inch broad, is now to be screwed to the bottom of the boat outside the canvas, for the protection of the bottom, and the stems can have a thin batten of wood or hoop, also outside the canvas, nailed to them for protecting the canvas at the bow.

The strips, F, F, F, are pieces of wood, 1 inch broad,  $\frac{1}{4}$  or  $\frac{1}{2}$  inch thick, fixed to the vertical ribs, and form a flooring protecting the canvas bottom from injury by the feet.

The sidepieces, as well as the fittings, F, F, and other interior fittings, should be varnished or painted. The canvas should be treated with three coats of boiled oil before painting, which should be done with two or three good coats of best white lead paint.

If the reader wishes to make an extremely light craft, the canoe given in Plans D and E will be found serviceable. It is made entirely of hoops and canvas; the Plan is drawn to  $\frac{1}{2}$  inch scale, the vessel being 10 ft. long and 1 ft. deep.

The light canoe, E, can be made solely of rattan or hoop, and if sufficient care is taken in construction, a boat that a man can carry on his back can be made which will easily bear one, if not two persons.

A plan of the sail and rigging is given. The quality is duck; size, 2 feet, or 3 feet if preferred, at the top, about 4 feet in height, and 3 feet broad at the bottom. The sail is fastened to the

mast; A, A, are two small brass "thimbles"; B, B, are cords called "brails," passing through both thimbles along both sides of the sail, and fastened at the edge; D, is a wooden pole or "sprit," pointed like a sharpened lead pencil, which slips into small loops sufficiently small to catch it at E and E. Then a cord called the "sheet" fastens the sail at G.

If it is wished to make the sail into a leg-of-mutton sail, the "sprit" can be taken out, when the top of the sail falls down into position, and is bound tight.

In furling the sail the cords, B, B, are pulled up, and the end, G, wrapped round the mast. The distance of E to C should be equal to E to A.

The mast must be made to pass through the wood, H, which must be strengthened suitably for the purpose of supporting the mast, and into a block of wood fixed on the keel, which must be made sufficiently strong.

In case of using a sail, or even without, the canoeist may find it advisable to use ballast, in the shape of sand bags.

The boat is steered with a paddle, which should have two circles of indiarubber between the centre and the ends to prevent water running on to the hands.

For suggestions in regard to the "rattan" boat, canvas, rigging, and other important points, the writer is indebted to the kindness of Captain Anthony Weale, of *Liverpool*, a gentleman of great experience in nautical matters, and well versed in the construction and management of all classes of craft, who, no doubt, will, through the Editor, advise desponding readers of AMATEUR WORK, if such can be found, on this or kindred subjects.

In conclusion, the reader, if he should decide to construct a canoe, should on no consideration attempt to use a sail, unless he is well acquainted with its manipulation, for, although at Jamaica, extremely light boats of this description proceed to the open sea carrying sail, yet everyone is not a West Indian, and this may be very disagreeably proved to the reader, unless he is cautious. A narrow stream and very fine weather are the best conditions under which to experiment for the first time, at all events.

## FITTING AND ERECTING.

By A FOREMAN PATTERN-MAKER.

## XIV.—SHAFTING.

**I**N important section of the fitter's work is the fixing of shafting and pulleys. In some districts this is a speciality of the millwrights, but in most shops the fitters do all work of this character. I will condense what I have to say on this matter into a single article.

Machines are driven either from the main or

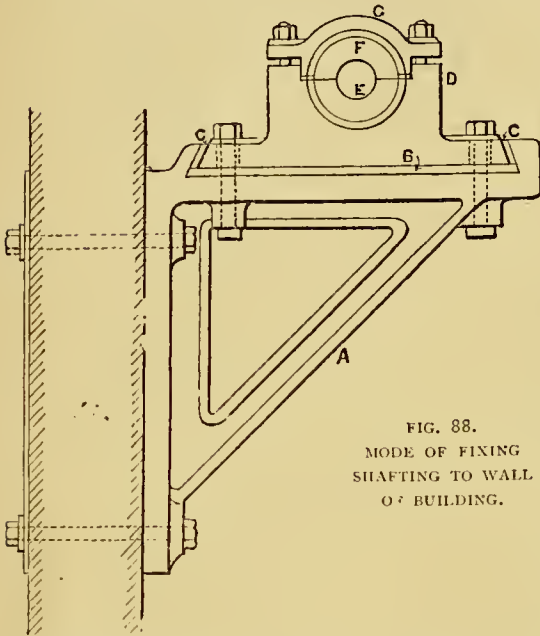


FIG. 88.  
MODE OF FIXING  
SHAFTING TO WALL  
OF BUILDING.

line shafting direct, or through the medium of a countershaft. There are two reasons for the use of a countershaft. First, the line shaft is always running, and if there were no intermediate shaft, there are many machines such as lathes, which could only be stopped by stopping the line shaft—a very manifest inconvenience. Second, the line shaft runs at a uniform speed (usually 90 to 100 revolutions per minute), while different machines require to be ran at different average speeds, and variations in speeds. The countershafts, therefore, fitted with fast and loose pulleys and speed cones supplies the means by which the machines can be stopped while the line shaft is running, and also be ran at various

rates of revolution. The relative dimensions of the belt pulleys upon the main and countershaft, and of the speed cones on the latter and on the machines, govern the rates of revolution.

In fixing shafting and pulleys the point of great importance, second only to the correct proportioning of diameters and strengths, is the lining and fixing in such a way that the shafts shall be parallel and in perfect alignment, and that the pulleys shall be hung at precise right angles with the shafts. Neglect of these points results in excessive friction and waste of power, cutting out of bearings, and slipping of belts. There are many matters involved in the elementary designing of shafting, pulleys, belts, etc., into which I cannot here enter, but which will be best summarised along with other matters in a final chapter. Just now, therefore, I shall confine my remarks altogether to the mere mechanical task of fixing these shafts and countershafts in such a manner that they shall run with the minimum of friction, and without slipping off of the belts.

For lining shafting we require a level, straining line, straightedge, and plumb bob, each or all, according to circumstances. Taking, first, the simplest case that will occur, the fixing of a length of line shafting to the wall of a building. The first thing is to get the wall brackets, Fig. 88, A, bolted to the walls as truly in line as possible, not absolutely, but so true that the hard wood packing beneath the plummer blocks, Fig. 88, B, and the wedges, c, at the ends of the feet of the blocks will supply afterwards all the adjustment required. The course to be followed is this :—

A bracket, say, an end bracket, is first fixed to the wall permanently with bolts and washer plates at the height required, measured from the shop floor. Since the floor may be uneven or out of horizontal, we fix the positions of all the other brackets, not from the floor, but by this first one just fixed. The assistance of a labourer is required, who holds or slings bracket No. 2 temporarily in place against the wall, while the fitter extends a long parallel straightedge over the tops of both brackets, and tests and adjusts with a spirit level until the height of bracket

No. 2 corresponds with that of No. 1. Then the bolt holes are marked on the wall directly from the bolt holes cast in the bracket foot, and bored, and the bracket bolted in place. The same process is gone through in the case of all the brackets along the whole length of the wall. These brackets now afford a fairly correct basis for the subsequent fixing of the plummer blocks. It is true they will not be quite accurate in the longitudinal direction, for we have said nothing about checking the brackets in a plane parallel with the face of the wall. The face of a wall is not perfectly linear, and, therefore, the brackets bolted to it will follow its contour. But, unless the building is in a very bad condition, the deviation will not be so great that account need be taken of it in the setting of the brackets. But in the setting of the plummer blocks which follows thereon, the straining line will be brought into service.

The first plummer block, Fig. 88, *d*, will be fixed at some determined position on its bracket, with wood packing underneath and wedges at the ends. The second bracket will be set on its wood packing, and the thickness of the latter altered, if necessary, until the height of both blocks is seen to be the same when tested with straightedge and level, the straightedge being laid upon the bottom, *e*, of the bored brass while the upper brass, *f*, and cap, *g*, are removed.

In this way all the plummer blocks in line will be adjusted for height, and most probably the thicknesses of the wooden packing pieces will vary from  $\frac{1}{8}$  to  $\frac{1}{4}$  of an inch at least. But, now, they will all have to be adjusted in the vertical plane, and to do this the straining line, of fine copper wire or twine, will be stretched taut between the bearings at the extreme ends. The line will be laid against one edge of each bearing, and the edges of all the other bearings will be brought into coincidence with the line, and then the blocks may be bolted down upon the brackets. After one bolt, we will say, is put in each, try the line again, and, if necessary, re-adjust the blocks by tightening and slackening the end wedges—an easy matter, since the feet of plummer blocks usually have their bolt holes made of oblong or slot shape, to permit of a

range of adjustment of  $\frac{1}{4}$  or  $\frac{3}{8}$  of an inch endwise. Also, at any future time, should the walls subside, or any one bearing or bearings become worn more than another, the packing blocks, the wedge, and the slotted bolt holes, permit of the making of such re-adjustments as may be necessary.

If a piece of shafting has to be carried along a wall at right angles with another piece, its position is first lined out upon the floor with chalk, using one of the geometrical problems for obtaining lines at right angles with one another, and then the position of the shaft in the one direction is plumbed from the line so obtained. In the horizontal direction the straightedge and level are employed, as already explained.

Countershafts are always in short lengths only, and they are run in bearings, sometimes attached to the wall brackets like line shafting, but more generally to brackets of "hang-down" or pendant type, whose feet are bolted to the joists or beams over, or nearly over, the machines driven by the countershafts. These hang-down brackets have to be adjusted and fixed in a similar manner to the main brackets. As a rule, the bearings in these are not fitted as separate plummer blocks but bored in the bracket, and there is, therefore, no means of adjustment except that afforded by the bolt holes, and the packing often inserted under the feet. All the more care, therefore, has to be exercised, the brackets being clamped in place, and their precise position fixed before boring the bolt holes in the timbers. The same remark, also, applies to those smaller wall brackets used for line shafting where the expense of separate bearings is dispensed with. In these, where the bearings are bored in the solid with the bracket, it is very difficult to secure perfect alignment, and it is necessary to introduce wood packing between the feet of the brackets and the wall to which they are bolted.

The parallelism of countershafts with the line shaft is secured by making use of the level in the horizontal direction and of the plumb line in the perpendicular, see p. 384, Vol. I., Fig. 77, the shaft being put temporarily in place, the line being made either to embrace the shaft and



depend from its centre, or made to pass down one side of it. Because of the difficulty of fixing bearings, and because of their unequal wear, and because shafts are not always true, the practice is often to use the swivelling type of bearings. In these the body of the actual bearing is of a globular form outside, and swivels in a plummer block hollowed to a similar form. If, therefore, the centre of the bearing is fixed at the correct position, the bearing will accommodate itself in the direction of its length to any inaccuracies in the running of the shaft. The value of these is most apparent in the case of the long bearings whose length is equal to three or four times their diameter, and which are used for shafts running at high speeds.

To get the corresponding pulleys on the shafts and machines in their relative positions the straining line is resorted to. The edges of pulleys are always turned true, and the line, therefore, is strained along the edges of the pulleys, and so being carried from driver to driven shows the relative setting on the shafts. If the pulleys on driver and driven are of the same width, then the cord must be in contact on opposite edges of each pulley. If one is wider than the other, proper allowance must be made, and measurement taken from the cord to the edge of one pulley. Care must be taken that the straining line is not accidentally drawn out of a truly linear position. A straightedge would be better on the score of rigidity than a cord only, but that in many cases it would have to be of great length, and, therefore, cumbersome to handle about. But it is quite essential that the pulleys are in line, for if otherwise, the belt will run to one side, and even slip right off.

Another essential point to attend to is, that the pulleys are keyed on their shafts so that their edges are at right angles therewith, and, consequently, their faces parallel. When the shafts are turned and the pulleys bored truly to the same diameter, they will run true without any need of adjustment. But shafts are sometimes rough, and the holes in the pulleys rough, or untrue, or larger than the shafts, and only by accurate keying on can the necessary adjustments be made. Then the shaft must be ran

round from time to time during the process of keying, and the truth of the pulley be tested with chalk applied to the more projecting sections. A very little inaccuracy will throw the belt off.

## NOTES ON NOVELTIES.

By THE EDITOR.

19. EXHIBITION OF HOME INDUSTRIES. 20. LOCKWOOD'S BUILDER'S PRICE BOOK. 21. THE BRITANNIA COMPANY.

19.  EXHIBITION OF HOME INDUSTRIES.—There will be an Exhibition of Amateur Work at the Crystal Palace on August 16th, 1890. The Exhibition will be held in connection with the Third National Co-operative Festival, and intending exhibitors must be members of some co-operative society. The exhibits will comprise specimens of engineering models, marine models, miscellaneous models, art metal work, general metal work, cabinet-making, joinery, house decorating, wood carving, wood turning, fretwork, toy making, painting on glass, china and pottery, photography, oil paintings, water-colour drawings, pen or pencil drawings, bookbinding, modelling in clay or plaster, musical instruments, confectionery, inventions, and miscellaneous collections. Silver and bronze medals, and certificates of merit will be given to those who excel in each class. The exhibits must be the *bona fide* individual work of amateurs. An entrance fee of one shilling will be charged for each class of exhibit. Full particulars may be obtained post free from the General Secretary, Mr. William Broomhall, 49, Bedford Street, Strand, London, W.C. The clause which provides that exhibitors shall be members of some co-operative society is not a difficult one to comply with. Any person may become a member of such a society by subscribing a small fee of a few shillings, but as the rules of these societies differ somewhat in this respect it is not possible to give exact figures, but I am sure that, upon receipt of a stamped addressed envelope, Mr. Broomhall will be pleased to advise anyone desiring information, and will direct him to the society nearest to the locality in which he resides.

20. *Lockwood's Builder's Price Book, 1890.*—This old-established price book for Builders, Architects, Contractors and Engineers, appears in the form of a new edition, greatly enlarged and improved. Every price given under the different trades has been revised, those for Measured Work having been calculated afresh. All the recent improved methods of construction, and every special feature of modern building, such as Electric Lighting, Ventilation, and the newest Sanitary Appliances, have been fully dealt with, and the work generally brought up to date. As a reference book for estimators, it is not surpassed by any of its competitors, and should be found on the desk of every Builder and Contractor.

21. *The Britannia Co.'s No. 3 Catalogue* is to hand. It is fully illustrated, contains one hundred pages of interesting matter, and as a guide to machines, tools, castings and motors of every kind that an amateur can possibly desire, it is well worth investing in. This book is forwarded post free for one shilling by The Britannia Co., Colchester.

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## AMATEURS IN COUNCIL.

For "Instructions to Contributors and Correspondents," see page 46 of this Volume, or Part 13 (New Series), p. 46.

## Lathe Workers Wanted.

R. S. writes:—"For years I have amused myself in making electrical apparatus, in the construction of which I have derived valuable aid from the articles which have appeared from time to time in *AMATEUR WORK*. I have managed to make, amongst other things, a Vacuum Tube Rotator, Induction Coil, Electro Motor, and Wimshurst Induction Machine, and I have been patiently waiting for an article on the construction of an Electric Tramcar. This month my patience is rewarded, but still I am not happy, in fact, I am much disappointed, for I fear I shall never be able to construct the car described in the article. There is too much lathe work in it, especially to one who has no lathe. It is all very well for the gentleman who wrote these articles to say it is easy to get someone to do the lathe work for you, but I do not find it easy at all, although I live near a large manufacturing town. I find it difficult, very difficult, in the first place, to get anyone to undertake such small jobs as I want done at all, and when I have found anyone who will do them, they are such a long time over them and charge so much for them that one gets disgusted, and to think it is better to purchase the things right out than try to make them. Wood-turning I can get done without so much difficulty, but, then, my experience of wood turners is that while they can turn a handle or a stand all right, when it comes to anything with a hole in it, as a wheel or a pulley, they are beaten, for they cannot make it true. I do not think I am alone in my experience of the practical difficulties in the way of getting small lathe work done. I believe it is a real stumbling-block in the way of many amateurs like myself. Is there any way out of the difficulty in this particular case? I want to make my tramcar but cannot at present see how I am to do it. Can any of the portions of the work, which must be made in the lathe be purchased anywhere, or can they be made in any other way?" [There must be many amongst the readers of *AMATEUR WORK* who have time and skill which they would be willing to exchange for a consideration. If such there be why not advertise the fact? Here is a chance for someone.—ED.]

## Dulcimer.

F. W. LAIDLAW.—The position of the iron bridge is indicated on page 123, Vol. 11. (Old Series), as almost parallel to the middle bridge, which is two-fifths from the right end, and, of course, three-fifths from the left. The instructions are clear on the important point, that the height must be such that the strings which rest on the middle bridge go over and clear of the iron bridge, and those that pass under the arches also pass under and clear of the iron bridge; but if the woodwork has been carefully done no iron bridge is necessary. With its four screws and nuts it would be very good to draw the soundboard down to the bar, B, in Fig. 6, but if necessary for one end, two would be needed, as the right-hand bar, B, is quite as likely to require drawing into contact with soundboard. On the whole, I should advise the iron bridge to be left out altogether, care being taken to ensure perfect contact between the soundboard and the bars and frame. In stringing do not forget that the stoutest wire is for the longest string, a mistake having crept in on page 122 on this subject. In tuning avoid as much as possible duplicates, as the compass of the instrument is much shortened by repetitions, and its usefulness much curtailed by omissions.—B. A. B.

## Telephones.

CLERICUS SECUNDUS.—It will be advisable to provide a separate line for your telephones, as the working of these are much impaired by the inductive effects of other lines, or disturbances in those lines when one of these form the return wire of your telephone line, or earth currents, when the telephone line is connected to a gas pipe. No. 18 or 20 copper or phosphor-bronze wire, well covered and insulated, should be used for both lines, and be sure to make good and clean connections. The telephones may need re-adjustment of their magnets. This may be done by unscrewing or screwing up the set-screw in the handle-end of the instruments, and thus bring the end of the magnet closer to, or place it farther from, the metal disc in the mouthpiece until the best effect has been obtained. Speak in a low sing-song tone, as this is more clearly articulated than any other. Thanks for your kind appreciative remarks.—G. E.

## Pin-hole Photography.

PHOTOGRAPH.—A cigar-box made perfectly light-tight, and lined with black paper or velvet, or painted dead black inside, is really all that is needed to

take a photograph. The pin-hole through which the image or rays of light are to pass to the sensitive plate should have an aperture of about  $\frac{1}{16}$  inch, and it is best for this hole to be made either in a disc of blackened card or tin instead of in the thick wood of the box. The aperture should represent  $\frac{1}{16}$ th of the distance between it and the sensitive plate, and the image will then be always in focus. The exposure must be a long one, and the operator must not expect microscopic sharpness of the image.

## Incandescent Lamp and Battery.

C. A. PHELPS.—I cannot advise you to attempt to make an incandescent lamp unless you understand glass blowing, but if you wish to light a small lamp with battery power, buy a five-c.p. Edison and Swan lamp (they make a special low-resistance lamp for battery work) and light it with five cells of a granule carbon battery. I have myself fitted up a light in this manner to use as a night-light, so that by moving a switch near the bedside I can have a light instantly. My battery consists of six jars, 5 inches in diameter and 7 inches high, in which the carbon plates with their binding screws, and the porous cells are placed, the outer cells being then filled with crushed carbon to within an inch of the top. Make a mixture of 2 parts saturated solution of bichromate of potash with 1 part of hydrochloric acid and fill the outer cells nearly to the top. For the inner or porous cells break up some chloride of ammonium and put  $1\frac{1}{2}$  oz. in each cell, then pour in 1 oz. of hydrochloric acid and fill up with water to the same height as the liquid in the outer jars. Now couple up in series and connect to lamp, and a good light should result. Instead of chloride of ammonium and hydrochloric acid in the porous cell, you may put into each cell 3 oz. of chloride of zinc (com.) and fill up with water. This battery answers my purpose very well. I have no unpleasant smell from it, and it will go two or three months without attention, except in summer, when I add a little water occasionally to make up for evaporation. Lighting by primary battery on a large scale is not, at present, a cheap method of obtaining light, although I have just had my attention called to a new battery of which great things are promised by the syndicate who have it in hand. However, I refrain from mentioning names until I receive certain statistics that I have asked for in connection with it.—ED.



### Canoe Building.

**BOATHOOK.**—To use wings as you suggest appears to be rather an inconvenient method. Your trouble arises from the great buoyancy of the boat. If the seats are near the gunwale, then the centre of gravity is too high, and should be lowered. Sit on the bottom of the canoe. A convenient seat can easily be made for this purpose, and the canoe worked satisfactorily. If still too light try ballast, iron plates, or weights conveniently placed inside, or, better still, bags of sand, never minding the lead keel at present. For myself I think three men are too much, and, if sitting high, will undoubtedly cause great leverage on a light boat. Try by yourself, as above suggested. I have followed this plan in your case satisfactorily. Perhaps you have made your boat too sharp in the bottom, with too little rounding.—J. H. M.

### American Organ.

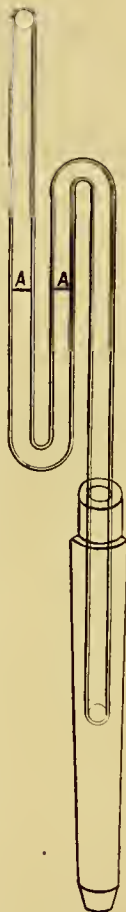
H. W. (*Whitchurch*).—1. One way of enlarging the bellows is to fix a new reservoir to the outside of the old reservoir board (having previously bored in it suitable holes), and place a pair of springs in the new reservoir, of the same strength as the springs in the old reservoir, the pressure will then remain the same as before, but the capacity will be increased. I have tried this and found it answer. Certainly, the only way to add reeds is to add another reed-board and wind-chest (probably placed behind the book-board, either horizontally or vertically), but this can only be done if, as I advocated, the case has been planned with a view to such addition. The only advantage of adding reeds after the instrument is finished is that thereby the initial expense is reduced, which might be a consideration with some amateurs. 2. The pedal part of organ music, as all organists know, sounds an octave lower than written, unless another register than the 16 ft. is specially indicated (see *Stainer's Organ Primer*), therefore by playing the pedal part on the manual, with the octave coupler drawn, an octave lower than written, the intentions of the composer are realized; and this can only be done if the manual reaches to 16 ft. C. I have an instrument with two manuals, both with a compass of six octaves from 16 ft. C., and I find the arrangement very satisfactory. Undoubtedly, it is better to have pedals, if only for the sake of pedal practice, but then you must have a blower, and engines are costly, and it is generally easier to find

a friend who will play with you than one who will blow for you; besides, by distributing the music between three or four hands the execution is greatly simplified.

### Wind Gauge.

**OCTAVUS.**—The accompanying sketch is an illustration of a wind gauge, or, as it should be called, an "anemometer." It consists of a glass tube, with two curves in it, fitted into a socket at one end. The drawing is a third the size of the one I always use. A piece of  $\frac{3}{8}$  inch glass tube, 20 inches long, is easily obtained, and bent into the required shape over a methylated spirit lamp or a Bunsen's gas burner, if chemistry is studied by the one who wants the gauge. Fit one end into a wood pipe foot in such a manner that it is impossible for any air to escape round the tube. Pour some water down the other end so that it will be level at A, A. The air then coming up the socket will pass into the glass tube and force the water down the middle and up the outside. The difference in distance between the two levels will be the weight of wind. This machine will weigh as high as six inches of wind.

If a heavier pressure should be required, the curves in the tube will have to be farther apart. It must be borne in mind that while the pressure of wind is being tested the reservoir of the bellows should be full to start with, as any movement of the feeders, no matter how slight, would cause a fluctuation of the water, thus making the measurement uncertain.—**ORGAN BUILDER.**



Wind Gauge

### Telescope.

J. D. (*South Africa*) wishes to know whether the power of his telescope can be increased, the only indication of its present power is that by it he can see persons at "a considerable distance," but cannot recognize the face. This at best is exceedingly vague. As the focal length of the object glass is not stated, neither the focal length of the eye-piece, no very definite information can be given—much depends on the quality of the object glass, whether it would bear a much higher power than its present eye-piece. Not knowing what means J. D. has to fit up an eye-piece, my advice is send the present one with particulars of the object glass to Mr. Lancaster, *Colemore Row, Birmingham*, and procure another of a higher power.—O. B.

### Revolving Bookcases.

W. D. (*Liverpool*).—I have some papers in hand describing the construction of these very useful contrivances. The articles shall be published as soon as space permits, and, under the direction of the author, I have no doubt that you will succeed in making one to your satisfaction. The fact that you have but few tools need cause you no uneasiness; you will only require a few, and all the contents of a tool-dealer's shop would be useless to you without the skill to use them.

### Subjects in "Amateur Work."

**ISRAEL GREENWOOD.**—Sign writing and lettering is a subject that demands so much space for its proper treatment that it must be postponed for the present. How to make stools and forms has been taken in hand for you by one of my staff. The best book on the lathe for you to commence with is "Turning Lathe," by J. Lukin, and you can get it by sending three shillings to The Britannia Co., *Colchester*.

### Violoncello.

**CULTS.**—You will find an article, "The Violoncello: How It May be Made," in Vol. VI. (Old Series), page 275.

### Telescope Construction.

**TWIST DRILL** writes:—"Should any readers of ours be engaged in this work I can confidently recommend Mr. W. Harding, 52, *Gladstone Road, Boscombe, Bournemouth*, as a practical working optician, who is obliging to amateurs, and has supplied me with excellent eye-piece lenses cheaply, not to mention much valuable information and assistance."



**Electric Bell Fitting.**

G. J.—The Leclanché outer cell or glass container is half-filled with solution of sal-ammoniac and water—enough sal-ammoniac to saturate the water, but not leave crystals at the bottom. In this cell the zinc rod or negative pole is placed. You are, no doubt, thinking of the porous or inner cell, which is filled with a mixture of equal volumes of binocide of manganese (needle manganese) and gas carbon, broken small and freed of dust, with a plate of carbon placed in the centre, which constitutes the positive pole. Further particulars if necessary. In answer to your other question, Fig. 1 will suit your requirements. A and D

structions given by T. Earl in Vol. III., *AMATEUR WORK*, but cannot get a trace of a picture, and asks for the reason. The mechanical part of the work seems all right, and the only thing I can suggest is that the lens is not of the right focal length. T. Earl has not given the focal length of lens, which is rather unfortunate. If I were making one I should procure a lens with focal length, say, an inch or two longer than the distance between the end of the box and the mirror, and bring the lens into focus by the adjustable tube. As far as the principle goes the blackened glass is all right for experimenting, but as it does not reflect the same amount of light as a silvered mirror, the picture must be

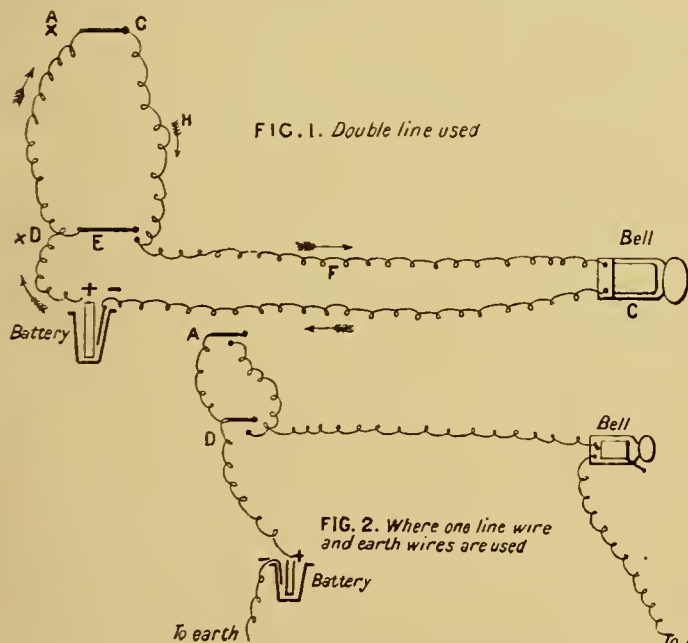
ing lamps of more than 5-c.p., and for this 6 cells are required. The light, however, is only for occasional use, such as a night-light, as the battery exhausts itself in a few minutes. This would be your experience with the Leclanché, no matter how many cells you employed.—A. T.

**Gas Engines.**

JAMES JOHNSON (*South Africa*).—These papers are now being written and will be published in due course. The author has promised to give instructions for making gas either for use with the engines he describes, or for lighting purposes. Colourists, like yourself, will, no doubt, appreciate this.

**Slot Joint.**

J. S. writes:—"Having received much help from *AMATEUR WORK*, it appears only right when one has a suggestion which is likely to be useful, to communicate the same for the benefit of my fellow-readers, and I think the following method of making a joint is likely to be



are the positions you name; c is the position of the bell. On the first contact spring E being pressed down the current proceeds from the + positive pole through E, along the line F, and bell, thence to battery—pole. When the contact spring at G is pressed down current proceeds from the + pole to A by contact spring G, lines H and F to bell, thence to battery. You can connect many different points in this way. I have adopted the precise position and their letters as given by you. Fig. 2 show connections where a single line and earth wires are preferred.—J. H. M.

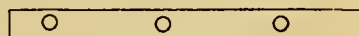
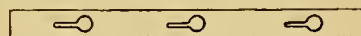
**Camera Obscura.**

LLANFAIR, P. G., has constructed a camera obscura, according to the in-

fainter. If this should meet the eye of T. Earl, perhaps he can answer the question as to the lens more definitely. In the meanwhile I would ask P. G. to inform me of the focal length of the lens he employs.—O. B.

**Leclanché Battery for Lighting.**

BILSHAVO.—To attempt to light two 16-c.p. lamps with a Leclanché battery would, I fear, end in disappointment, as the Leclanché is not suited for this work. It may be done, but it would be like setting small boys to perform the work of horses. Giving a rough guess, I should say it would require between 20 and 30 cells, the exact number depending on the resistance of the lamps. The Leclanché is seldom used for light-

**SLOT JOINT.**

so. It was shown me by a practical carpenter a few days ago. We will suppose it is a piece of 1 inch pine that has to be jointed and glued up. When the edges are perfectly true, run a gauge mark down the centre of each, and in one piece, every four or five inches, put in a 2-inch screw, leaving about  $\frac{3}{8}$ ths of an inch projecting. On the edge of the other piece bore holes with a centre-bit large enough for the head of the screw and about  $\frac{1}{2}$  inch deep, then cut a slot about  $\frac{1}{2}$  inch long with a small chisel the size of the diameter of the plain part of screw; now glue the joint, insert the heads of screws in the corresponding holes. A few taps with a mallet on the end of the wood will drive the screws up the slot, and the heads cutting their way will draw the joint perfectly tight. I think it will appear quite plain from the diagram."

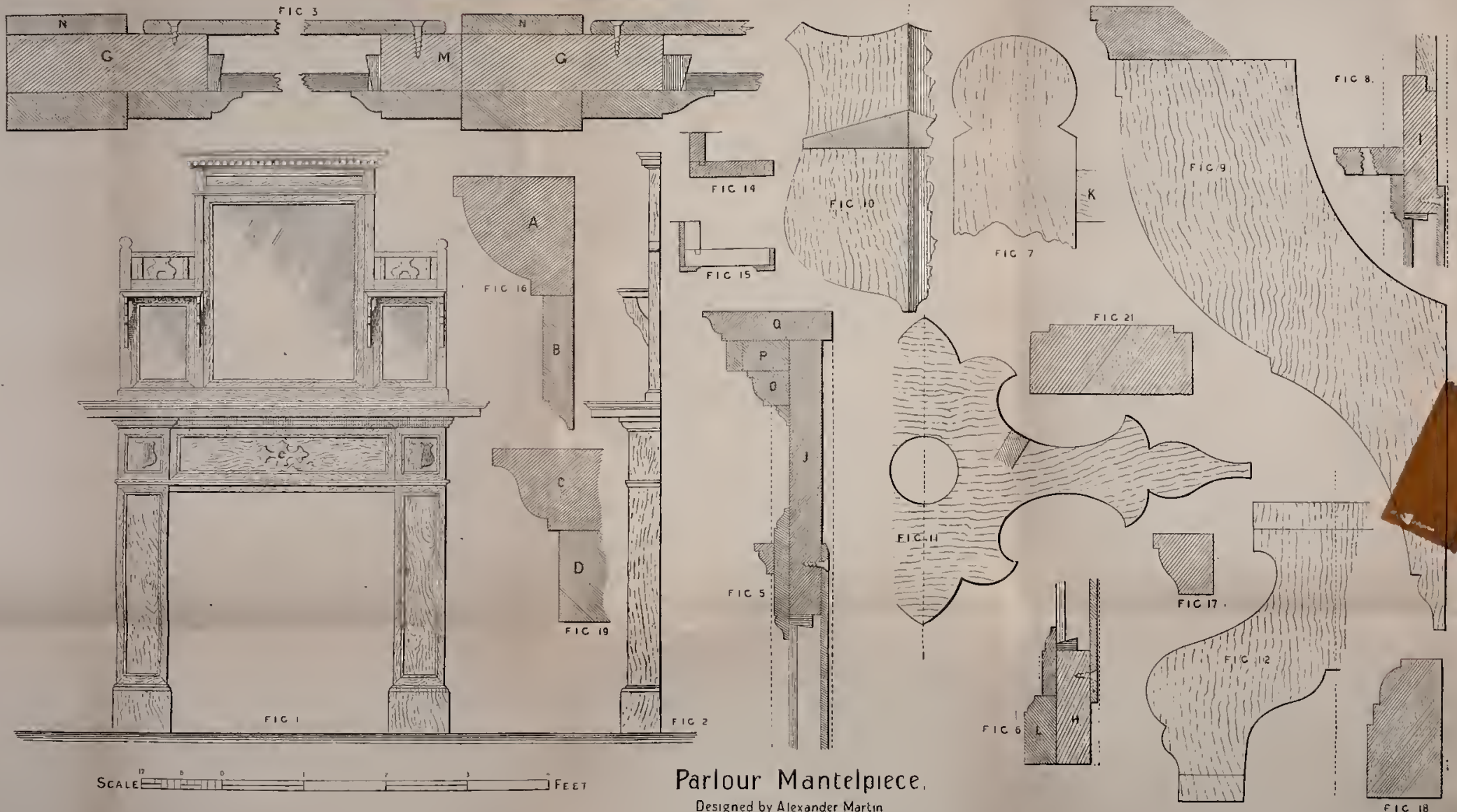
**INFORMATION SUPPLIED.****Waterproofing Boots.**

D. W. B. (*Liverpool*) asks for suggestions in regard to waterproofing boots. I send him the following recipes which he might try. (1) One part mutton suet and twice the quantity of beeswax melted together. Apply it to boots with a cloth day and night, and wipe









Parlour Mantelpiece.

Designed by Alexander Martin







## JOINTS USED IN TIN PLATE WORKING.

By H. J. W.

**T**HERE are many names used in the tin trade of which an outsider is perfectly ignorant, but which every "amateur tinsmith" who is really interested in his work should know.

For instance, Fig. 1 represents a joint or seam which is used in articles innumerable, more especially for bottoms of bread tins, dripping tins, and flaring articles. This joint is known in the trade as a "turn-up" seam or joint.

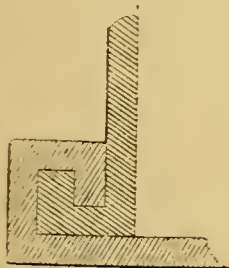


FIG. 1.—TURNED UP SEAM.

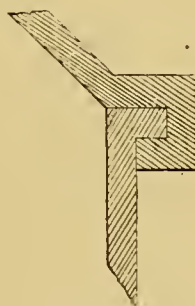


FIG. 2.—PANNED DOWN SEAM.

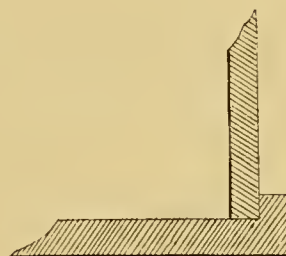


FIG. 3.—CLAPPED ON SEAM.

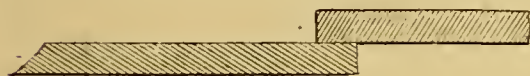


FIG. 4.—SOLDERED SEAM.

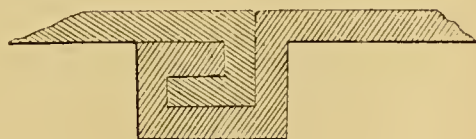


FIG. 5.—LOCK SEAM.

Fig. 2 represents a joint or seam which is used for fastening the conical top to the body of an oil-can or bottle, and is known as a "panned down" joint or seam.

Fig. 3 is a joint which is used more than any other by "amateur tinsmiths" and apprentices, and is termed a "clapped-on" seam or joint. It is used for cash boxes, and various other articles.

A seam where two pieces of tin overlap each other (see Fig. 4) is known as a "soldered seam." This is used for bodies of articles, rims, etc.

Lastly, a seam which is used for stove pipe and joining two tin plates together, is called by the English "a grove seam," and by their cousins, the Americans, a "lock seam"; the latter is, I

think, the more appropriate term. Fig. 5 represents this joint.

I have no doubt that many amateurs have experienced some doubt in wiring their articles, as to how much tin to turn over; this is made easy by measuring the wire, which we will say is  $\frac{1}{8}$  inch diameter; the amount to turn down on the hatchet stake is twice the diameter of wire; in this case  $\frac{1}{4}$  inch, which will be found to cover the wire nicely, not too much, but just enough to hide the wire from view.

The drawings are eight times larger than the original, to convey the idea as to how the joints

are made, and will, I think, need no further explanation, since the joints themselves are of the simplest nature, the only difficulty lying in the refractory nature of the material to be joined. A little practice soon overcomes this and gives the skill which the proper performance of all mechanical work demands.

FOR WRITING ON GLASS a varnish of sugar is recommended. It is made by dissolving equal parts of white and brown sugar in water to a thin syrup, adding alcohol, and apply to hot glass plates. The film dries very readily, and furnishes a surface on which it is perfectly easy to write with a pen or pencil.

## PLUSH MIRRORS: HOW TO MAKE THEM.

*By J. C. OGDEN.*

PERHAPS, of all articles of drawing-room furniture, a handsome mirror is the most attractive and the most essential. The truth of this is at once made manifest when one enters a room which does not contain a mirror. No matter how handsome the furniture, how elaborately upholstered the chairs, etc., how fine the pictures, there is a certain deadness, a sense, in fact, of something wanting, something which will infuse a little life, a little cheerfulness into the room, which at present possesses but little of these, if, indeed, it possesses any at all. It is, I believe, a well-known fact, that every mirror, no matter how small, tends to increase the light of a room, and in consequence, the more numerous, and the larger the mirrors, so much the lighter and more cheerful the room. This is very evident in the gaslight, because the light of each jet is reflected from every mirror which is within reach of its rays, thus increasing the light of the room to a very great extent. Handsome mirrors, however, are very expensive, and are, therefore, not as frequently seen as they might be. It is my intention, however, in this article, to describe the construction of a mirror which is handsome and large, and which at the same time has the merit of being comparatively inexpensive. Moreover, it is so easy to make that even the most ignorant amateur will, with very little trouble, be able to manufacture it. As will be seen from the illustration, Fig. 1, the mirror has a plush frame, and is relieved by three brackets, together with two brass candlesticks. This, when properly and neatly made, makes an extremely beautiful ornament, and may be suspended either over the mantelpiece or in any other part of the room. Let us then proceed to construct our mirror.

The first thing to which we will direct our attention is the frame. This, from the maker's point of view, is the most important part of the mirror, as any defect or inaccuracy in the frame is liable to spoil the appearance of the whole of the work. The size of the frame which I shall describe is 3 feet long by 2 feet 6 inches broad.

It, may however, be made larger or smaller to suit the taste of the reader. The width of the wood is 7 inches, and the thickness 1 inch. Any kind of wood may be used; deal is very suitable, and as it is very inexpensive, I should recommend deal. First, then, cut two strips of wood 3 feet long and 7 inches broad, and two strips 2 feet 6 inches long of the same breadth and thickness. Mark off 7 inches from each end, and between these two points cut a rebate  $\frac{1}{4}$  of an inch deep on one side of each strip, as shown in Fig. 2. This rebate is intended to hold the glass in position, and, therefore, great care should be taken to secure perfect accuracy. Plane and sandpaper these strips, both back and front, and then proceed to fasten them together. This may be done either by mitreing, mortising, or halving. I think, however, the last named way will be found to be the best, as it takes up less time than mortising, and will answer just as well, since both back and front of the frame will be covered. For the benefit of those who may not know how to halve, the process is shown in Figs. 3 and 4. Let the frame be very securely fastened together, however, and take very great care to make the joints fit well, as the effect will be spoiled if the four corners are not exactly even. This can be very easily tested by means of the square.

The frame of the mirror is now complete, and we may at once proceed to cover it. If thought necessary, the whole may be given a coat of paint previous to covering. This having been done obtain the required quantity of plush, about  $2\frac{1}{2}$  yards would be ample, but this depends a great deal upon the width of the plush. However, it is very easy to ascertain the right quantity by measurement. The colour of the plush must be left to the discretion of my readers, as tastes differ. For my own part, I prefer either a dark green or a gold, as these are not only very serviceable, but match with almost anything. Amber looks very beautiful, but unless great care is taken it soon becomes soiled. Blue or crimson I do not recommend, unless they are required to match other articles of the same colour. As I have said, the choice of the shade of plush rests entirely with the reader, and I strongly advise him to consider well before deciding. I may be permitted, however, to remark

that it is advisable to get a good silk plush. Cotton is, of course, much cheaper, but it neither looks so well, nor is it as durable as silk. I advise the reader to inquire for remnants before purchasing, as he will most probably find one to suit him. A figured plush also looks much prettier than a plain one, in my opinion, and is also more serviceable. This, again, however, is purely a matter of taste.

Having, then, obtained our plush (which may cost as little as 1s. 6d. per yard) we will proceed with our work. First cut the required quantity for the cross-piece, *A*, Fig. 5, leaving, as shown, a margin of about 1 inch all round, taking care to let the plush overlap the back of the frame at least an inch. Now fasten the plush at the back of the frame with small upholsterers' tacks. Having done this, cut the two slits, *E* and *F*, and then turn down and fasten the part *o*, inside the groove which we have already cut for the reception of the glass. The shaded pieces may now be cut off, and the remainder nailed down, as shown in the figure. This will leave the frame as in Fig. 6. Now proceed in the same way with regard to the other cross-piece, *B*.

Having finished our cross-pieces, let us proceed to cut out the plush for the two uprights, *C* and *D*, leaving exactly the same margin as in *A* and *B*. Go on as before, first fastening the plush at the back, and then cutting the slits *E* and *F*, as in Fig. 7. Before fastening down the part, *o*, however, turn in the shaded parts, *x*, *x*, so as not to leave a rugged edge, previously moistening the part to be turned under with a little stiff gum, or still better, glue (see Fig. 7A). This, if done neatly and carefully, will hide the joints, and will give to the frame the appearance of being made up of one single piece of plush. Now fasten down the part, *o*, in the groove, as before, and turn parts, *x*, *y*, over the back, and fasten them down. The way to fasten and finish off the corners neatly is shown in Fig. 8. Having finished the upright, *C*, proceed in the same way with the other upright, *D*. The frame will now be completely covered, and if the instructions given have been carefully followed, the joints, etc., ought to be imperceptible, and the whole frame ought to present a very neat appearance. The greatest care is needed in turning down the

parts, *o*, neatly, as it is of importance that the joints in the corners should be hidden as much as possible.

Having now got our frame covered, we will direct our attention to making the brackets which are to ornament each side; these may be made either plain or ornamental, at the discretion of the reader. Either look well; but if the reader has the time, and would care to go to the trouble, I should recommend him to spend some little time over the brackets, and make them as elaborate as possible, as they contribute in a wonderful degree to the appearance of the mirror.

To make the brackets, first obtain seven pieces of wood  $\frac{1}{2}$  an inch thick, measuring 5 inches by  $3\frac{1}{2}$  inches. These should then be shaped as in Fig. 9. Plane and sandpaper them well, and then paint them carefully on both sides with black paint or, better still, enamel. These constitute the tops of the brackets. For the supports cut seven pieces of wood 3 inches wide and 4 inches long, and shape them as in Fig. 10. If the reader is anything at fretwork, however, I strongly advise him to cut out the supports, and to ornament them with a fretsaw. I append a few designs. These supports may be cut out in any of the various fretwoods. They may be painted black, or left plain, according to taste. They look extremely well cut out in sycamore wood, and then sandpapered clean. As I say, they look very well if done this way, and at a distance can with difficulty be distinguished from ivory.

Now proceed to fasten the supports to the tops of the brackets. This should be done by glueing them together, taking care that the support shall come exactly in the centre of the top part. I say glue them together, because this saves nailing or screwing, which, although far more simple, is at the same time far more risky, as the wood may split, or the nails may be visible. Still, that is the only objection to nailing them together, and the reader may fasten them together in this manner if he chooses.

We now proceed to fasten these brackets to the frame. This is done by driving in three screws from the back, as shown in Fig. 11.



Take very great care to have the brackets an equal distance apart on each side, or the appearance of the mirror will be spoilt. Let the one at the top come exactly in the centre, as shown in the figure. Now make and screw on the large bracket for the bottom of the frame. This should be  $10\frac{1}{2}$  inches long and  $3\frac{1}{2}$  inches wide, and

differ in pattern, the choice of which must be left to the reader.

The frame is now completed, and is ready to receive the glass. This should be plate-glass of good quality. Be very careful in measuring the exact amount required, as if too small the glass is practically useless. The tighter the glass fits

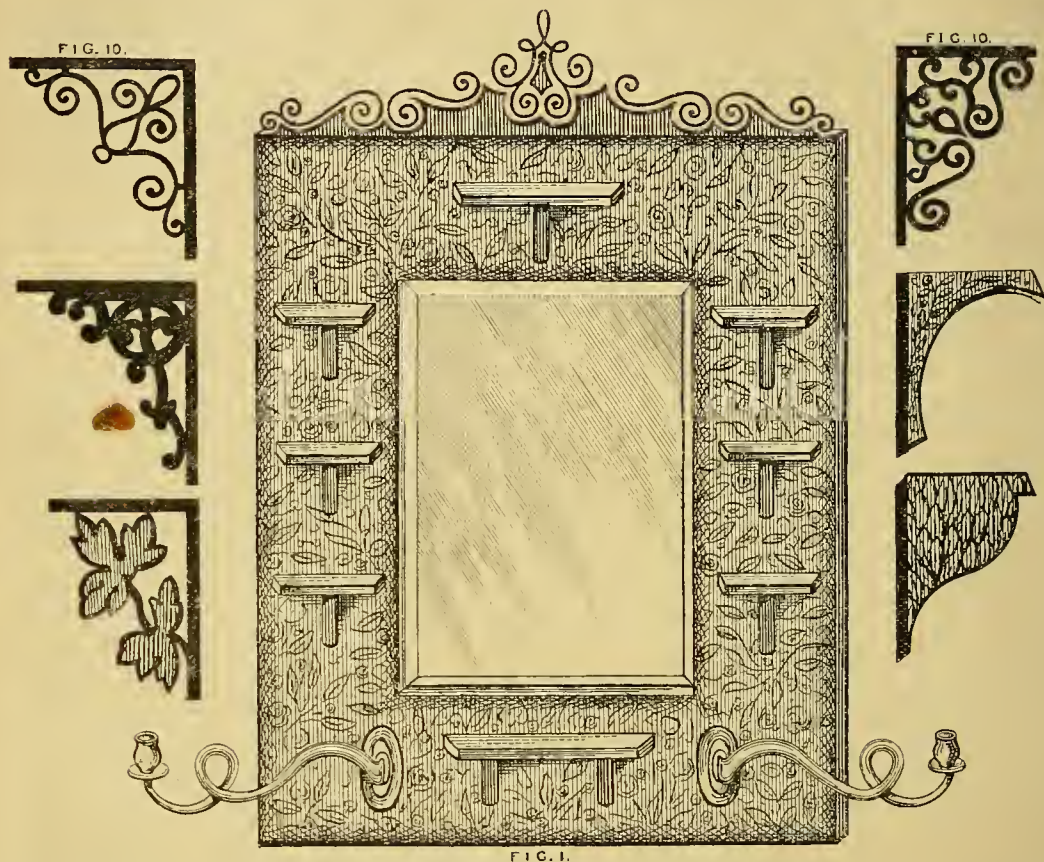


FIG. 1.—THE MIRROR COMPLETE. FIG. 2.—REBATE FOR GLASS. FIGS. 3 AND 4.—METHOD OF HALVING PIECES TOGETHER. FIGS. 5, 6, 7 AND 8.—METHOD OF CUTTING AND FASTENING DOWN THE PLUSH. FIG. 7a.—BACK VIEW OF FRAME, SHOWING THE PARTS XX IN FIG. 7 TURNED IN. FIG. 9.—SHELF. FIG. 10.—ALTERNATIVE FORMS OF BRACKET. FIG. 11.—METHOD OF FIXING SHELF. FIG. 12.—METHOD OF HANGING THE MIRROR.

should be supported by two supports of the same size as the others, one at each end. Now procure the candlesticks, and fasten them, one at each side, just over the joints of the plush, as in Fig. 1. These candlesticks are to be obtained from any fancy shop or furniture store. They cost from  $6\frac{1}{2}$ d. each, upwards. Very suitable ones ought to be obtained for 1s. 6d. each. They

in the frame the better. Bevelled plate-glass looks much better than the plain, but is more expensive. I think, however, and I believe my readers will agree with me, that considering the difference in the price of the two (which is comparatively slight), bevelled plate is far the best to use. Fasten in the glass by nailing a thin piece of wood, such as is used for picture frames,



FIG. 2.



FIG. 9.

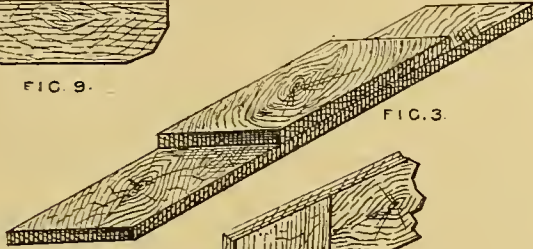


FIG. 3.

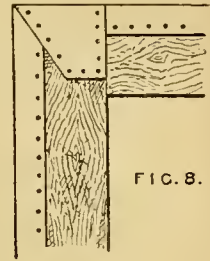


FIG. 8.

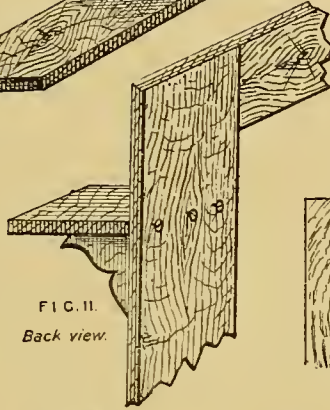


FIG. 11.  
Back view.

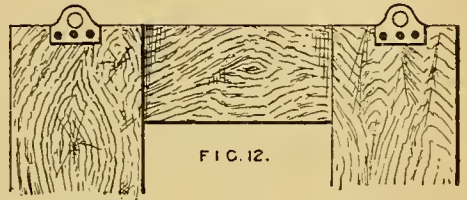


FIG. 12.

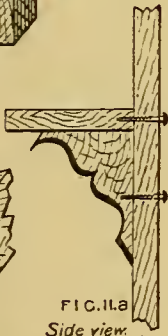


FIG. 11a  
Side view.



FIG. 4.

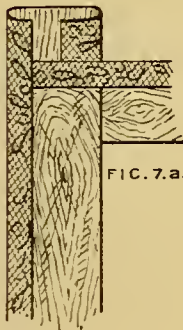


FIG. 7a.

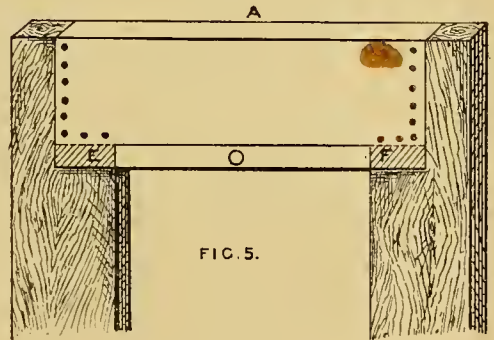


FIG. 5.

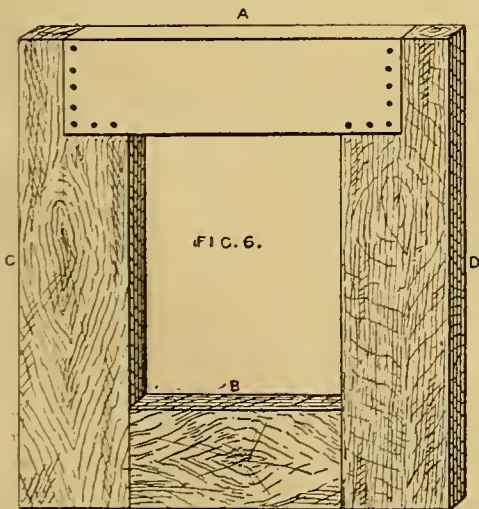


FIG. 6.

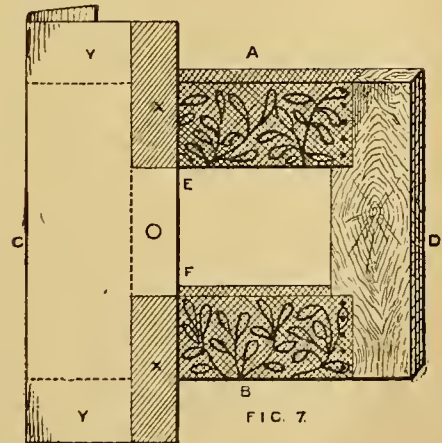


FIG. 7.



over the back. Now glue or tack a piece of strong black calico over the back to cover up the joints, etc., and to give a neat appearance to the whole. The mirror will be suspended by fastening brass loops at the top of the frame, as shown in Fig. 12.

Our mirror is now virtually finished, and if the work has been done with any amount of care, and if the directions given have been implicitly carried out, the reader will have a mirror which would have cost several pounds to buy. Not only, however, will he have saved by it, but he will have the pleasure and satisfaction of knowing that he has made for himself an ornament which is, without doubt, exceedingly beautiful, and at the same time extremely useful. Of course, it is left open for the maker to make any alterations and improvements he may think proper. For instance, if he be skilled in painting, he might ornament the glass by painting a few flowers or birds, etc., on it. This he would find to add to the appearance of the mirror to a very great degree. Or again, if he would care to take the trouble, he might make a fretwork top for the mirror, something similar to Fig. 1. This, too, would still further improve the appearance of his work. In fact, the artistic reader will doubtless be able in many ways to add to the beauty of the mirror.

**ZINC PLANT LABELS.**—A Correspondent of *The Scientific American* says:—A very simple and entirely satisfactory method that I have practised for thirty years past is to write on them with a blacklead pencil. A few hours after the writing is made it becomes fixed, and cannot be removed except by the use of an acid or by scouring. The zinc should be slightly oxidized before the writing is done.

**TO OBTAIN A HARD SMOOTH SURFACE ON WOODEN PANELS.**—To obtain a hard, smooth, glossy surface on wooden panels for art decorating purposes, dissolve gum shellac in alcohol, add enough drop ivory to make it thick enough to apply with a brush; put on three or four coats, rub down with rottenstone; when dry wipe off with a woollen rag, then varnish with a first-class thin varnish.

## HOW TO MAKE-UP FOR THE STAGE.

By PROFESSOR LIONEL ARTHUR.

II. — AMATEURS' "MAKE-UP" OUTFIT — THEATRICAL WIGS, ILLUSTRATED AND DESCRIBED—THEIR CARE AND TREATMENT—HIRING FEES—ANTON'S PATENT GERMAN FIBRE WIGS—PRICES OF SAME.



PROMISED to commence this chapter by giving an abridged list of the various toilet articles which the actors' make-up box should contain; so we will consider the subject at once. The most important item is that of grease paints, and although all colours come in very handy—to the professional actor in a stock company especially—the amateur would hardly ever require those tints at the lower part of the list. For the latter, some nine or ten colours will be amply sufficient; and the following will be found a very useful assortment:—

- |                 |                         |
|-----------------|-------------------------|
| 1. White.       | 6. Blue—dark.           |
| 2. Light flesh. | 7. Carmine.             |
| 3. Dark flesh.  | 8. Chrome.              |
| 4. Black.       | 9. Lead grey or orange. |
| 5. Brown.       |                         |

Black, brown, and blue are for lining purposes principally, and should be had in the thin 4d. sticks; it is advisable, though, to have thick sticks of brown and black also, for darkening the hair, eyebrows, or moustache. A neat box, containing eight useful colours, can be purchased for 2s. 6d. The following will complete a small but useful outfit suitable for beginners:—

A. Homburg's wig paste, 1s. 3d.; rouge, 6d.; hare's foot for same; spirit gum, 6d.; camel's hair brush for same; cocoa butter; cold cream; vaseline; ruddy rouge; Indian ink; Fullers' earth—box and puff; violet powder—box and puff; powdered blue; powdered antimony; scissors, needle and cotton, glass, and crêpe hairs, brush and comb, towel.

These few articles, as I have already said, can be packed away in any box, wooden or cardboard, but they last much longer if kept neatly and cleanly, and the box divided into various compartments. Professionals, as a rule, throw everything into the receptacle for these articles in one confused mass, consequently they are



always losing something, and everything is in a dirty and untidy state. I am now going to illustrate and describe some of the most important wigs in use upon the theatrical stage.

*Wigs.*—Upon a well-made, artistic, and neatly-fitting wig depends the success of almost every and any make-up, and to this point much care and attention should be given. I shall have more to say on fitting and shaping wigs when I come to the actual work of making-up for various characters, so need say no more at present, beyond giving a list of wigs, and the characters they are suitable for.

*Dress Wigs.*—These wigs are worn for all modern parts in ordinary dress, such as Society dramas, farcical comedies, etc. They may be had in the following shades of real hair, and with side or centre partings: fair, golden, light and dark brown, black, grey, white, iron grey, and red. "Imitation hair" dress wigs, side or centre parting, cost 10s. each, in all colours, at Fox's.

*Scratch Wigs.*—Are made of short wiry hair, without any parting. They are worn principally in comic and serio-comic parts, such as "Box and Cox," "Sam Weller," "Walker Chalks," and "Bill Sykes," and also in characters such as "Château Renand," "Wormwood," "Jack Sheppard," etc. They are kept ready-made to suit these and other well-known characters.

*Bald Wigs.*—There are several descriptions of wigs of this class, and I may say it is a very important class, too, as nothing requires so much care and skill as making-up for character parts in which a bald wig is used. The names under which these wigs are known are: Character Bald, Character Half-bald, Old Man Comic Bald, Old Man High Forehead, Iron Grey Half-bald, Shylock, Spriggins, and many others named after celebrated characters. The character bald wig is used generally, a good specimen of which is Fig. 5. The character half-bald, Fig. 6, is a favourite wig for light comedy old men in melodramas. Fig. 7 is the old man comic bald, a wig which may be used with much success; and Fig. 8 is the same wig, but consisting principally of a scalp, with merely a few straggling hairs at the back. This wig is used when depicting very old age in any character,

especially, though, the old and feeble rustic in the smock-frock, the old village wiseacre who knows everything, but takes so long to tell it. Fig. 9 is a straight hair wig, bald in the centre; Fig. 10, old man's high forehead wig; Fig. 11, Father Christmas white flowing wig, bald at top; Fig. 12, Shylock bald wig; Fig. 13, Spriggins wig with whiskers, and bald at back; and Fig. 14 is another half-bald wig for serious characters, and similar to the one worn by Mr. Wilsou Barrett in "The Silver King."

*Flowing Wigs.*—These wigs are worn principally in Shakespearian plays and dramas of Charles I. period, both earlier and later. There are also certain shapes used for other characters, such as "Peter Spyke," "Iugomar," "Pygmalion," "Faust," etc.

During the reign of the monarch mentioned, as well as other reigns, wigs were, of course, worn in everyday life. Cavalier wigs are similar in appearance (see Fig. 15). A flowing wig will be shown in the illustration which I shall give of the make-up for Charles I.

*Court and Tie Wigs.*—These are worn in powder and costume plays, such plays consisting of the old comedies of the Restoration period, as "Wild Oats," "School for Scandal," "The Rivals," etc. Figs. 16 and 17 are Gents' Court bag and powder wigs.

*Miscellaneous Wigs.*—There are several descriptions of wigs used principally for grotesque and humorous characters; these include such parts as Chinamen, Half-castes, Quakers, Mephistopheles, Clowns, and Pantaloons. By referring to the figures 18 to 24, the reader will see at a glance which wigs are suitable for these and other peculiar characters, and can then order what he wants with a certainty of getting it correct. Barristers and judges' wigs are too well known to need any description. There are other wigs besides those mentioned, which are identified with particular parts, and are named after the characters, so that it is only necessary to mention the character a wig is required for, and the perruquier will know at once what to supply. Such wigs as these are Hamlet, Paul Pry, Rip Van Winkle, Dundreary, Middlewick, Eccles, Micawber, Ally Sloper, Sir Peter Teazle, and a host of others.

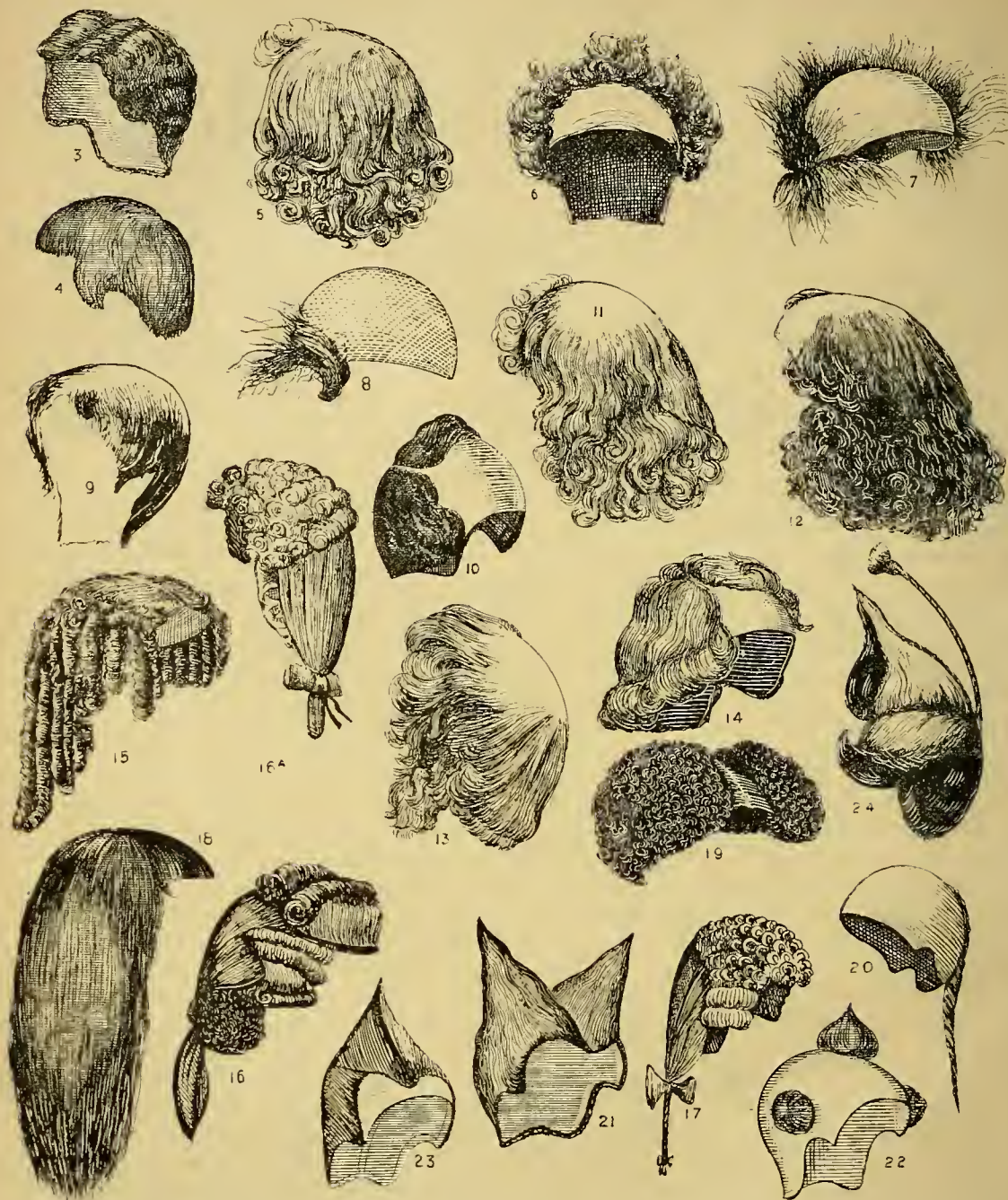


FIG. 3.—DRESS WIG, CENTRE PARTING. FIG. 4.—SCRATCH WIG. FIG. 5.—CHARACTER, BALD. FIG. 6.—CHARACTER, HALF BALD. FIG. 7.—COMIC OLD MAN, BALD. FIG. 8.—DITTO, OLDER. FIG. 9.—CENTRE BALD. FIG. 10.—OLD MAN, HIGH FOREHEAD. FIG. 11.—FATHER CHRISTMAS. FIG. 12.—SHYLOCK, BALD. FIG. 13.—SPRIGGINS, BALD AT BACK. FIG. 14.—HALF BALD, LONG HAIR (SILVER KING). FIG. 15.—CAVALIER OF CHARLES II. FIG. 16.—GENT'S COURT BAG WIG. FIG. 16A.—GENT'S COURT WIG. FIG. 17.—POWDER WIG. FIG. 18.—QUAKER'S WIG. FIG. 19.—FRIZ WIG FOR EITHER SEX. FIG. 20.—CHINAMAN. FIG. 21.—MEPHISTOPHELES. FIG. 22.—ENGLISH CLOWN. FIG. 23.—FRENCH CLOWN. FIG. 24.—PANTALON.



Wigs are both expensive and somewhat fragile articles, and require very careful treatment, or they soon become very rough and unsightly. With the putting on and fixing of wigs we have, at present, nothing to do; but I may give a few hints here as to their treatment when not in use. An oval japanned tin bonnet-box is the best thing in which wigs may be stored, but a wooden box will answer the purpose nearly as well; the former, however, is lighter, and not so clumsy, and keeps the moths away better. As soon as a batch of wigs are done with after a performance, they should be carefully gone over with a hair brush, turned inside out, folded lengthwise, and each wrapped separately in a sheet of tissue paper; a little paper label, with the name of the wig on it, may be pinned outside, so that each wig may be identified without opening the paper covering. They should then be packed carefully away in the box, and the lid kept securely shut; it is better to have the box locked, to prevent the wigs being handled by the curious, or they may be often "donned" by one's friends, especially young ladies, "just for the fun of the thing," in which way many a good wig has been irreparably injured. It is also necessary, if the wigs are long out of use in the summer time, to examine them occasionally for moth, as the writer once had some valuable wigs completely ruined by being eaten away by moths. A piece of camphor in the box would probably act as a preventive, however, against this evil.

It would take up too much space here to give a full list of the wigs made by Mr. Fox, of Russell Street, W.C.; suffice it to say, that they are all manufactured from the finest materials, and are well worth the money asked for them. A large stock of second-hand wigs is also always on sale at this establishment, and some good bargains are often to be picked up in this way. Mr. Fox also lets out on hire wigs of all kinds, for which his terms are as follows:

*Hiring Fees for Wigs.*—Wigs for male characters, first night, per wig, 2s. 6d.; second night, 1s.; third night, 6d.; per week, 5s.

Wigs for female characters, first night, per wig, 3s. 6d.; second night, 2s.; third night, 1s.; per week, 7s. 6d.

*Anton's Patent Fibre Wigs.*—Mr. Albert Homberg, 8, Briggate, Leeds, has lately introduced these cheap German wigs into this country, and they are excellent value for the money; in fact, nothing so cheap has ever been offered before. I append a short list.

|                     |                    |
|---------------------|--------------------|
| Scratch wig, 3s.    | Powder wig, 4s.    |
| Modern dress, 3s.   | Geut's long hair,  |
| Scratch wig,        | 4s.                |
| smooth, 2s. 6d.     | Mephisto., 3s. 6d. |
| Court wigs, 4s. 6d. | Monk, 3s.          |
| Japanese, 3s. 6d.   | Judge, 5s.         |
| Clown, 3s. 6d.      | Louis XV., 4s. 6d. |
| Pantaloon, 3s. 6d.  | Clear scalp, 2s.   |
| Chinese, 2s. 6d.    |                    |

Illustrated catalogue, with full list, 3 stamps.

These wigs are very light, fit well, and can be dressed in various styles; they are sewn, and not pasted, and are very useful for pantomimes, processions, etc., where a large number are required. To pack these wigs without damage, crush in the crown of each, and pile one upon the other, and they will come out quite perfect again.

(To be continued.)

*POTATO PAINT.*—The *Oil and Colourman's Journal* gives a new kind of paint for flatted work. Take one pound of potatoes, peel and boil till cooked; mash well and add sufficient water to the consistence of thick cream, then pass it through a hair sieve. Add two pounds of Spanish white or fine whiting, mixed with four pints of water, and the result will be a paint of a fine milk-white colour. Can be changed to black or grey by the addition of lampblack, and into red or yellow by the different ochres. The mixture dries rapidly.

*CEMENT* with which to fasten stone to stone, or iron to iron, is made by mixing a paste of pure oxide of lead, litharge, and glycerine. This mixture hardens rapidly, is insoluble in acids, and is not affected by heat. It has been used to fasten the different portions of a flywheel with success, while, when placed between stones, and once hardened, it is easier to break the stone than the joint. [Not tested.]



## NOTES ON DR. BUCKELANDT'S WATER-DEVELOPING "WATERLOO" DRY PLATES.

By "OUR PHOTOGRAPHIC ARTIST."

DEVELOPMENT WITH WATER—THE INVENTION AND ITS  
ADVANTAGES—DIRECTIONS FOR DEVELOPMENT AFTER  
INSTANTANEOUS EXPOSURE—DIRECTIONS FOR DE-  
VELOPMENT OF A "TIMED" EXPOSURE.



SINCE Amateur Photography sprung so suddenly into fashionable existence, through the introduction of dry plates, no latter-day innovation has been more welcomed amongst amateurs than the invention and manufacture of water-developing dry plates. When I say that these plates develop simply in cold water, and that the employment of any special developing bath is entirely dispensed with, their success is not surprising.

I will, before describing them, just allude to a few of the advantages which these plates possess over the ordinary article. In the first place, we all know that very few amateurs are in the lucky possession of a dark room, and that the numerous assortment of bottles which are stored about the various cupboards of a house, some containing poison, are a great and constant source of annoyance to the female members of the family. Besides, a great many amateur workers are so careless, that it is positively dangerous to leave chemicals about in the way of one and all, as many do. The water-developing plates dispense with all these tiresome bottles, with one exception—the fixing solution.

These plates, however, will be found of the greatest advantage to the photographic tourist, who is so desperately fond of doing his laboratory work in the hotel bedroom, after a hard day's tramp with his "kit." We all know it is best to develop without delay, because if any of our negatives should prove to make bad pictures, we may then have a few more shots before leaving the neighbourhood. Nothing is so annoying as waiting until one's arrival home before developing, and then to find half our plates turn out spoilt negatives, and without any hope of getting another chance of taking the same subject for years, or, may be, for ever. With

the water-developers we have only to procure a jug of cold water from the chambermaid, and proceed to bring out the result of our day's work, which should be ready next morning for giving off trial prints. For the purpose of taking these trial prints, I would recommend my readers who go touring, especially abroad, to take a few of Durnford's patent printing frames, as they take up so little space, and are very strong and light in weight. They are made by our old friend William Tylar, of Birmingham.

Let us now come to the plates themselves. The originator of the water-developing dry plates is Dr. Leo Buckelandt, Assistant-Professor of Chemistry at the Belgian State University in Ghent. Dr. Buckelandt is an ardent A. P., and hit upon the idea of putting the developing substance on the back of the plates in such a manner, that when placed in water it should dissolve, and thus form the developing bath. His great knowledge on chemical matters helped him, not only in this, but also in compounding a gelatine film of unsurpassed excellence. For the purpose of manufacturing plates according to Dr. Buckelandt's invention, well-appointed works, fitted with the best machinery, have been erected at Ghent.

The developer on the water-developer is quinol, better known as hydroquinone, a non-staining reagent, and much cleaner than pyro. This with the other chemicals, is spread upon the back of the plates in the shape of a paste, which dries into a hard surface. The plates are made of very high sensitiveness only, viz., 60 times (25 Warnerke). The reason why slow plates are not manufactured is, that it has been discovered by Dr. Buckelandt that development may be retarded and altogether managed in such a way that it matters not if the plates have been over-exposed, for they produce good negatives all the same, and consequently these plates may be used for ordinary landscape work with most perfect success. This is brought about by using a small quantity of sodium-sulphite, a saturated solution of which should always be kept handy.

Given correct exposure, nothing is required but to place the plate in the developing dish, put on the water as afterwards described, and

rock until development is completed. Should it be considered that the development proceeds too quickly, it is best to make a practice of putting one or two drops of the saturated sodium-sulphite solution into the dish before putting the plate and water in. For landscape negatives this should always be done, and in case of over-exposure, and whenever the image comes forth too quickly, the addition of a few drops more of the solution will retard or arrest development, so that good negatives may be got with even five or six times over-exposure, which is not possible with any other class of plate.

It should be noticed that as the developer dissolves gradually, the bath also becomes fortified gradually, so that really the same effect is obtained as if a series of baths of increasing strength were employed; and this is one of the important features in the water-developing dry plates. But the greatest feature of all in the "Waterloo" dry plates, whether of the water-developing class, the ditto transparency plates, or the ordinary variety, is that they allow a greater latitude of exposure than any ordinary kind of plate; therefore they are the very thing for amateurs. They are very rich in silver—a great consideration, and the coating of the emulsion is very uniform.

As my space is extremely limited, I will now proceed to give working directions in as few words as possible.

*Directions for development after instantaneous exposure.*—The emulsion, as already said, is very rapid on the water-developers, and each plate carries its own developer on its back in the shape of a hard dry crust. Having exposed the plates, take a dish, *the proper size for the plate*, pour in water, the colder and softer the better. Now hold the dish on the slant, put in the exposed plate, film upwards, then briskly bring dish in horizontal position, so that the film gets uniformly moistened. Scarcely any of the developer will yet have had time to dissolve, and any surplus water must therefore be at once poured away, so that no more remains than is just necessary to form a wave over the film when the dish is rocked. This is very important, otherwise a yellow stain on the film will be the result. It is, however, as well to

have a good quantity of water at first, in order to get the film evenly moistened, and to prevent air-bubbles, and so piu-holes, on the resulting negative. On the other hand, the quantity of water on each plate is calculated to be about  $\frac{1}{2}$  an ounce for a quarter plate, 1 ounce for a half plate, and 2 ounces for a whole plate, and so on; and therefore that which has been poured into the dish in excess of that quantity should be poured off immediately the film is moistened, to prevent the yellow stain. I cannot say that this stain is a defect, as it does not seem to cause slowness in printing, but oftentimes gives a more harmonious and softer print. But in pyro-developed negatives we know that a deep yellow-stained film is very slow in printing. Here we have an advantage over pyro. Upon this point Dr. Buckelandt says: "Believers in ruby or yellow-stained negatives, which in the opinion of many produce the softest and most delicate prints, may easily obtain such by using more water than that prescribed, and *no sodium-sulphite*."

It is commendable, but not necessary, to add to the water a few drops of saturated sulphide of soda solution, which increases density, and acts as a restrainer; and if the image comes up too quickly, add more of it until things proceed satisfactorily, according to individual liking. In order to facilitate solution of the developers from off the back of the plate, the plate should, from time to time, be taken out of the dish. Rock and keep film well moistened until development is completed, and then thoroughly wash the plate in several changes of water, taking care that every grain of undissolved developer which may still adhere to the back is entirely removed.

*Development after a long exposure.*—Proceed exactly as already laid down, only using from the first a little more of sodium-sulphite solution. If, however, a long exposure has been given and a foggy negative is feared, two drops (for half plate) of saturated potassium bromide solution may be used, and proceed as usual.

I have said that only one bottle containing the hypo-bath need be carried by tourists, and that is certainly true so far, even if sodium-

sulphide and potassium-bromide is added to the kit, as the quantities required of these restrainers is so little that they may be carried in a couple of small phials in the waistcoat pocket. At any rate, two ounces of each would be amply sufficient, and it would, I think, be handiest to keep them in dropping bottles; then all is as simple as well could be.

Now as regards rapidity. I have already said they are sold as 60 times, and I have myself proved them to  $23^{\circ}$ — $24^{\circ}$ ; so this speed may be taken as fairly correct. Of course the rapidity of a plate is its greatest point for many subjects.

As regards the prices, they are very moderate, and can be obtained from the London house; and I would certainly advise everyone to give the "Waterloo" plates a trial, both the ordinary series and the "water developers." Dr. Leo Buckelandt's address is, "Professor of Chemistry, State University, Ghent, Belgium"; and his representatives in this country are Messrs. C. R. Bonn   & Co., 41, *Eastcheap, E.C.*

## HOW TO MAKE A CAMP LANTERN.

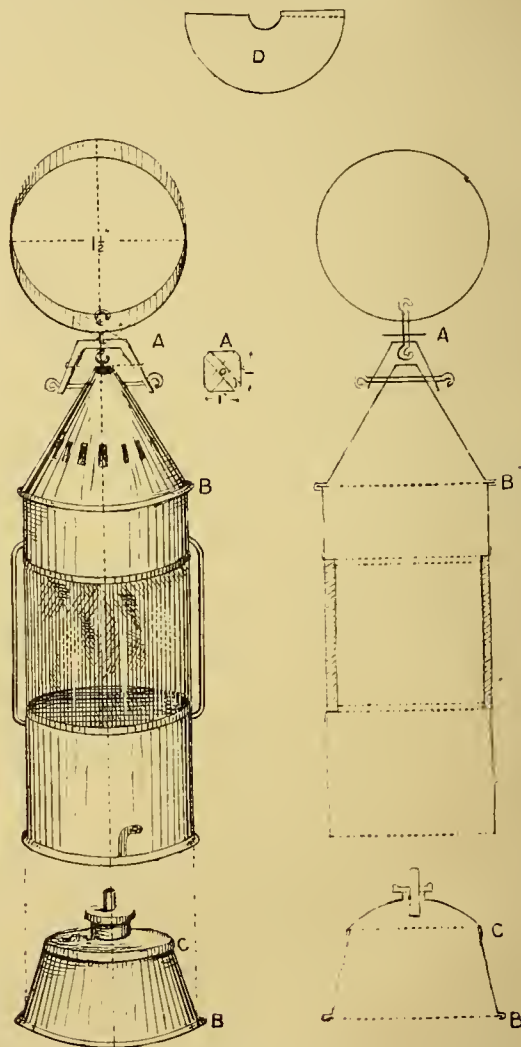
By H. J. W.

**T**HIS is easily made. First secure a pit glass, which you can get at most ironmongers for two or three pence. Having got it, we will proceed to work.

*Body.*—Cut two pieces of tin, one 1 inch deep, the other  $1\frac{3}{4}$  inches deep, and make them fit nicely around glass. Turn the edge down on top piece, and pan a conical top to it. (Conical top cut like d. Panning is the name of a joint made like b, sectional elevation). Make a ring, square, etc., and fix on top as per drawing. Next make three stays, and solder around glass. To make these, cut three pieces of wire the required length, bend at each end, and solder to top and bottom pieces, also drop a little solder in inside of bottom piece, to prevent glass dropping too far down, and cut a notch out of bottom piece for lamp to be secured.

*Lamp.*—The lamp is very easily made, and I

do not think needs much description. The bottom is panned on (see b, sectional elevation) and top clapped (see c, sectional elevation). The body of lamp, being tapered, should fit nicely at bottom, with a rivet soldered at side to secure same. Burners may be bought at an ironmonger's, and what is known as a wick screw, costing ninepence per dozen.



For those of our readers who are thinking of camping out this summer, this lantern will be handy. It does capitally for slinging to the tent pole, and will stand a considerable amount of hard usage without coming to grief.



## CASES FOR MUSICAL INSTRUMENTS, GUNS, ETC.

By B. A. BAXTER.

ONE of the great charms of flutes, clarionettes, violins, etc., is their portability. The player can take his own instrument with him to his friends' houses,

Surely the amateur might, with a little assistance, make cases for his own instruments, especially as in some instances the requirements are special.

We shall not in these articles treat of violin cases, as articles on that particular form of case have already appeared.

Let us suppose the amateur wishes to make a

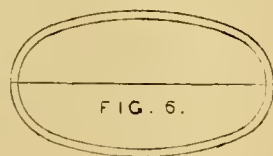
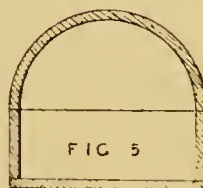
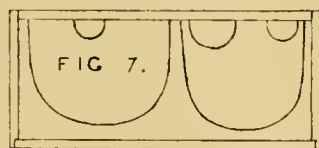
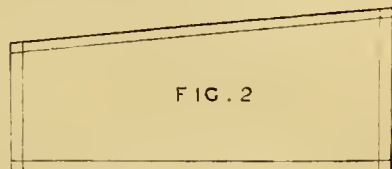
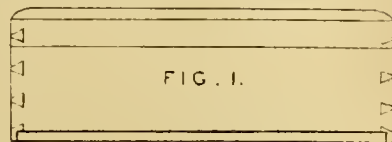
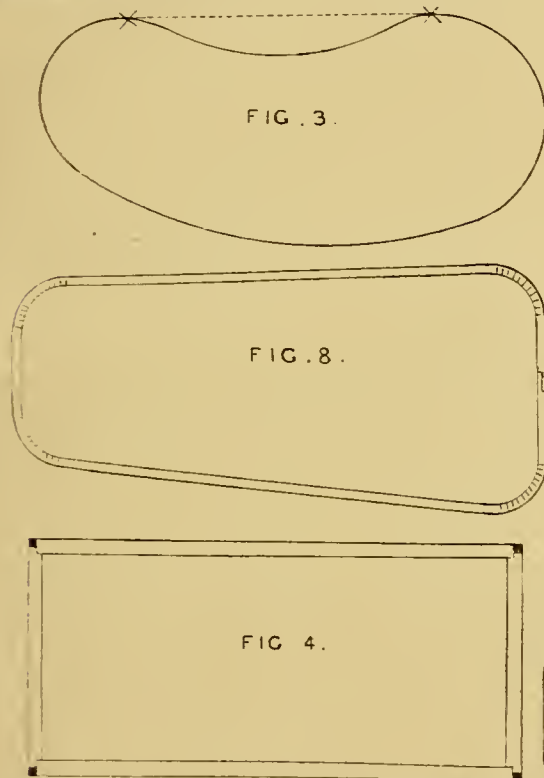


FIG. 1.—ELEVATION OF DOVETAILED CASE (BOTTOM SHOWN IN SECTION). FIG. 2.—PLAN OF FIG. 1 AS DRAWN TO OBTAIN ANGLES AND LENGTHS OF ENDS AND SIDES. FIG. 3.—SHOWING POSITION OF HINGES IN CURVED-EDGE CASES. FIG. 4.—MODE OF NAILING TOGETHER CASE FOR VENEERING (BLACK SQUARES ARE OF HARD WOOD). FIG. 5.—SECTION OF SHAPED CASE PLANED OUT OF SOLID FOR VENEERING, ENDS PUT ON BEFORE VENEER. FIG. 6.—SECTION OF THIN WOOD CASE (FOR COVERING WITH LEATHER) BENT ROUND SOLID ENDS. FIG. 7.—BLOCK CASE CARVED TO CONTAIN INSTRUMENTS; IN LIGHT WOOD FOR PAINTING OR COVERING.

and he becomes attached to his own instrument, in consequence of his continual companionship, in a way that a player on several varying instruments that are practically fixtures never does.

The portability of an instrument, however, generally involves a case, for unless the instrument is very small, as a piccolo or fife, a case is a necessity.

Then again, guns, pistols, surveying instruments, etc., all call for cases of a suitable kind.

wooden case. If he is able to do a little cabinet work, he will, no doubt, choose a hard wood, such as oak, walnut, or mahogany; if so, we will try and explain how to proceed.

We shall ask our instrument-case maker to arrange the instrument, in parts if it is capable of being taken apart, in the most compact manner that is possible, always remembering the fact that the case must have one straight side for the hinges, except indeed those rare instances where the side can be concave, as in

Fig. 3. A case shaped thus must have the hinges at x x, and a line drawn from one to the other must not include any portion of the case; it is obvious that the case would open just as freely if the dotted line formed the boundary, instead of the hollow curve. We will, however, suppose our first case to have straight sides. It is also obvious that the case must be either as wide as, or wider at the opening than it is at the bottom; so having all the parts of the instrument compactly placed together, we will measure carefully the size of the bottom of the case needed, and join up (if necessary) a pine board large enough for the purpose. I need scarcely remind readers of *AMATEUR WORK* that pine can be had in various thicknesses, and that 11 in. is the ordinary width.

The bottom of a case rarely shows, and pine will generally do nicely; if, however, the case is required to be, say, 14 in. wide, American white-wood (so-called) can be had in various thicknesses at very moderate prices, 14 or 15 in. wide, and is light, when dry, which is absolutely essential, is tougher than pine, and holds glue very well indeed.

Having obtained the necessary size and shape on the prepared bottom, allowing extra for the thickness of sides and ends, and having tried imaginary sides and ends at *right angles* to the bottom, gauge lines can be drawn all round bottom equal to the thickness of sides and ends; it would be safer to again try to place sides and ends on the spaces included by the gauged lines, and see if the dimensions are correct. We do not want the case too big, only just allow enough for lining and any partitions that may be needed; for as we shall have to fill up any spaces to prevent our instrument moving about, we had better have as few such spaces as possible.

Supposing our bottom is correct, it will at once indicate the length of each side and the angle of its end—tried from the face, of course; the angle on the edges of sides had better be a right angle in almost every instance, the bottom also might be marked, so as to indicate the depth at each corner, which, with an allowance of the thickness of the bottom extra, will give us the width of each piece at each end; in cutting these, above all things mark the outside and the bottom edge

with pencil. Amateurs make more mistakes through neglecting this precaution than through any other cause, and it is harder to make them believe that it is necessary than anything else upon which they are called upon to trust a teacher. Therefore excuse a little dogmatism on this point.

The sides and ends having been planed exactly to the sizes and angles required, a gauge stroke lightly made with a sharp cutting gauge can be drawn, and the corners dovetailed. We must beg the amateur to take care that the sides are out of winding, and that the angles of ends of opposite sides are equal, tested from edges of each, or else the whole will be forced into winding. Before actually cutting the dovetails, the inside lower edges must be rebated for the bottom, unless indeed the bottom is of the same wood as the rest of case when it may be planted on.

In cutting the dovetails, allow one to be a little larger than the rest, in order that the cut open of the lid and the necessary planing may not reduce the dovetail too much; and the position of dovetail and cut open ought to be so arranged that this larger dovetail is divided equally by the cut open.

The sides having been thus joined together, the bottom may be fitted into the rebate prepared for its reception, and fixed with glue, and panel pins carefully driven a little askew; on the whole being dry, the top edge may be carefully planed and the top glued on; this will be found to be rather a difficult operation, but the following expedient will assist: drive three or four small panel pins into the top edge about  $\frac{1}{2}$  inch in, cut off with plyers within  $\frac{1}{4}$  inch from the wood, file the sharp edges of the pins off, then lay the proposed top, inside up, on the bench, lay the incomplete case upon it bottom up, carefully adjusting its place, then a little pressure will imbed the pins in the top; if necessary the pin-holes can be deepened with a bradawl, and our friend will find that on glueing the top and fixing a few hand screws, that he will have no trouble with the top sliding about. When dry the whole can be cleaned off, and the edges rounded. Dovetailed points are peculiarly suitable for this sort of work, the rounding of the corners scarcely diminishing the strength at

all, while the rounding also diminishes the appearance of end grain.

In cutting open the case, care must be taken not to cut in winding. If parallel to top, a circular saw bench has been found useful by the writer; but if not to be parallel, then two *opposite* sides or ends had better be gauged with a marking gauge, and the other two sides ruled with a pencil and straight edge. The whole can be cut with a tenon saw, and to fix partitions, a lock, hinges, and handles complete the cabinet work of a hardwood case.

In putting on the lock, the writer wishes to give some advice: The lock had better be a work-box lock, or a pianoforte lock. Proceed as follows:—Measure the front, halve it, and mark with square on front of case, measure from edge of lock to centre of key pin, mark same on squared line, bore for key with small centre bit or twist bit, just an easy fit, cut neatly for bit of key with sharp chisel or penknife, cut out for edge of lock on edge of box, then cut for body of lock, fix, and then fix the hinges, using gauges to determine the cutting in for thickness of hinges; after the hinges are nicely fixed, fit and fix link plate, which can be done by putting it in lock, shutting box, and the plate will make its own mark on the under side of lid.

The handles can go on after the polishing, but with a view to avoid scratching or defacing the surface, the holes and any other needful preparation can be made beforehand.

The partitions can be made of thin pine, and if any are needed curved to follow the outline of the instrument, then they can be "saw-kerfed" like a coffin, half-way through, sawing on the concave side.

It may be that our friend wishes to veneer his case; if so, he can nail together a pine box of the requisite size, and he had better let in corner pieces; thus (Fig. 4), wherever the corners are to be rounded, he will have to carefully size with thin glue any end grain that he wishes to veneer; but unless for a telescope or plate case, we should not recommend veneer. For a painted case, dovetail by all means in clean pine, free from knots and shakes.

As far as lining is concerned, the most important requirement, next to the perseverance of

the worker, is a warm shop. Cloth, baize, or velvet is good for lining; in each of these materials cut out the largest pieces first, say the top and bottom about three-quarters of an inch too big all round, the smaller pieces can be cut out of the remnants better than the reverse proceeding. "*Experientia docet*," and it is said it does it very well. Cut the sides a little bigger than required, and glue the *case* sparingly with thick glue; or if thin glue, wait awhile before applying the lining. Be very sure to glue well up to the edges of the case, as there will be no turnings, and imperfectly glued edges curl up and look very bad. In adjusting the lining to the hinged lip of the box, the lid ought to be detached; let the lining just cover the edge, the superfluous material being cut off when glue is dry with a sharp knife; the superfluous cloth on the other edges can remain, press it well into the angle with a bone paper-knife or similar tool; the insides of top and bottom can be covered by cutting a piece of stout brown paper the exact size and shape, a piece of wadding barely as large, lay the velvet or cloth best side down on the bench, then lay the wadding, then the brown paper, pass glue brush along edge of brown paper, the left hand holding all three in proper position on the bench, still retaining its hold, fold the superfluous velvet, etc., over the brown paper with fingers. In doing this carefully avoid messing all the fingers with glue; the thumb and first finger especially endeavour to keep clean.

Having thus made two thin cushions that exactly fit, a little glue applied to the inner sides of the top and bottom will fix these cushions, and the covering of them is accomplished. We have now the partitions to cover and to fix; nothing but the instrument itself will indicate what is required, but whoever has done the rest will have no difficulty in covering the partitions. In every case except paper glue the *wood*, stretch the covering from the bottom edge over the top edge to the bottom of the other side of partitions. The fixing of partitions is very much facilitated if small pieces are glued to the ends or sides; each side of partition or small grooves could be cut before the lining is put on.

**LEATHER CASES.**—These cases should be made of pine or other light wood; nailed together will



do, but large unstayed flat surfaces do not lend themselves well to leather covering.

One the writer once made for three clarionets, and covered with leather (black skiver) went quite hollow on the top in the centre, through the leather contracting in drying.

The lesson we may learn from it is that a large unstayed leather covered surface ought not to be flat, but had better be slightly convex.

Leather covered cases are very suitable for any that have to have curved edges, or a case which resembles an oval tin canister.

A form of leather covered case the writer once saw, also for three clarionets, was made of a piece of solid pine cut out suitably for the reception of the instruments, and thin solid ends nailed on; it was not nearly as heavy as would be supposed, and was a convenient shape when closed.

For cheapness and strength, however, leather cloth is first rate; a thin pine board, such as 14 or 16 cut, glued, and nailed round a shaped end, and covered with leather cloth, would make an excellent case for cornets, etc., and would cost very little for materials.

Cases for music, books, etc., can be made quite easily of cardboard covered with leather, glueing the card board; this, however, is more nearly allied to bookbinding. In every case of the use of leather for covering, the edges are to be pared down; this is done with a sharp knife on a hard wood block, or preferably a piece of plate-glass. A suitable knife can be bought at the leather-cutters for about 6d., it must have a long thin blade, with a straight sharp cutting edge; but for a small piece of leather, a wide chisel thinly ground and well sharpened will answer the purpose.

In making a case preparatory to covering the outside with leather, especially if the edges are curved by means of kerfing, the sides ought to be fixed on the top and bottom, and care must be taken to fix top and bottom in perfect correspondence, or the whole thing will be askew; of course, "kerfing" will only be done where necessary, and every kerf must be cut square, the kerfs sized with thin glue, and afterwards covered with thin linen or papering canvas or upholsterer's scrim. A case for a violoncello

could easily be made on this principle, and covered with leather would be strong enough for any reasonable use, and would look far better than the cases full of complicated joints, made in the attempt to follow with straight surfaces an instrument full of curves.

Still another way of forming curved outlines consists of bending thin layers of wood round a block or model; but as no amateur could reasonably be expected to excel in that method, no space need be wasted in describing it. It would not pay to make the required model unless several identical articles were required.

Cases for small goods, such as pipes, cigar-holders, opera-glasses, bracelets, etc., are generally cut out in pine, either entirely or in part, and covered with leather, and lined with velvet. An amateur handy with a gouge or chisel, could easily make these cases, though the procuring of the fittings would be troublesome. Application to Thos. Turner and Co., City Road, London, would, no doubt, overcome the difficulty.

The writer made several very pretty cases for spring roller fire screens by grooving out a long straight piece of pine the shape of letter D in section; these were fixed on a walnut base, had hard wood ends fitted, and were in some cases covered with plush, in others veneered with walnut, and polished. This plan would be useful for cases for flutes, conductors' bâtons, small telescopes, microscopes, and other cylindrical things.

The junction of the edges of the leather covering is likely to be the chief difficulty to the amateur; an examination of one of these cases will show a line drawn with a warm steel tool compressing and smoothing the leather, and, no doubt, also causing the glue to hold the firmer.

The amateur is strongly advised to examine critically every specimen of good work in these varied branches of case making, and to endeavour to analyse the construction of each; just to the extent he is able to do this, and to devise plans whereby he may imitate them, he will approach the finish and satisfactory result he has in view. He will find that while the amateur admires a work and enjoys it, the workman is merely exercised by an enquiry as to how it was made, and has no admiration to spare as to the result.

## AN ORNAMENTAL JAR IN TURNED WOOD.

By ROBERT W. COLE.

**T**URNERS and who are fond of turning, and who chiefly occupy most of their spare time in that fascinating branch of mechanics, are frequently in great need of fresh designs. When they have manufactured specimens of the ordinary productions of the lathe, such as egg-cups, napkin-rings, chessmen, draughts, etc., they begin to look about for some new designs on which to exercise their tools and skill. It was when I was in a difficulty such as this that I conceived the design which I will now proceed to lay before the reader.

Fig. 1 is an illustration of the ornamental jar, copied from a photograph. Its extreme height is about 22 inches. It is composed, essentially, of four parts—the lid, the jar proper, the stem, and the stand. There will be no occasion, I think, to give the proportions of the various parts, as they may be easily judged from Fig. 1. The lid, which tapers almost to a point, and which meets the top of the jar at a place indicated by a faint shaded line in Fig. 1, is composed of two pieces securely fastened together, and has a series of holes drilled through the circumference of its lowest part. The stand is in the shape of a hexagon, is partially covered inside with plush, and has a ledge round its circumference also covered with plush. The stand is supported on six turned feet, one being placed at each of the corners.

Having thus obtained a general idea of the

jar, we will now proceed to construct it. The jar proper is the most convenient part to begin with, and as it is generally the most troublesome part to construct we will make it first. Chuck a sound piece of wood on a lathe, see that it is free from knots and cracks, and turn the outside perfectly flat and smooth; then turn the lower end for about  $\frac{1}{4}$  inch in length  $\frac{1}{2}$  inch less in diameter than the rest, and slightly round off the part which is near to it, as shown in Fig. 2. When you have done this, hollow out the inside carefully and evenly, leaving the sides about  $\frac{1}{8}$  inch thick. If you use soft wood, you will be able to hollow it out best by boring a hole right down its centre as far as you intend to hollow it, and then boring it out with a hook tool inserted into this hole. Be very careful in chucking the piece of wood that it is firmly fixed on to the chuck, as its length is considerable, and it would be extremely annoying if it should fall out of the chuck when nearly completed. A very safe method of chucking it is to square one of the ends when revolving between the centres of the lathe, and then to screw it on to a face plate, placing the squared end against the face plate. When you have finished turning the jar, thoroughly sandpaper it, first of all with coarse and then with fine sandpaper, and polish it with French polish.

Next turn a slab of wood about  $\frac{3}{4}$  inch thick and of same diameter as the jar, bore a hole right through its centre  $\frac{1}{2}$  inch in diameter, polish one side of it, and cut it off; then mount it again on the lathe, with the polished side turned towards the mandrel, and hollow out the other side  $\frac{1}{4}$  inch deep and wide enough to fit tightly on to the lower part of the jar, on to

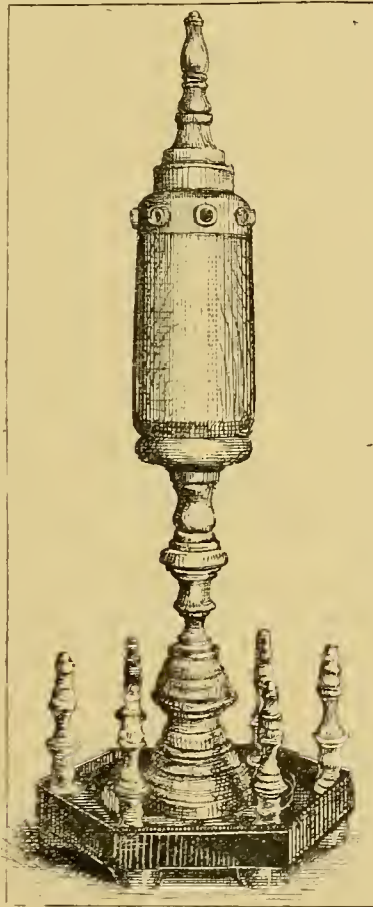


FIG. 1.—ORNAMENTAL JAR IN TURNED WOOD.

which it must be glued. This slab of wood is represented by Fig. 3, and is also shown in Fig. 1, just between the lower end of the bowl and the top of the stem.

The next part which we will make is the stem. This is narrow at the top and wide at the bot-

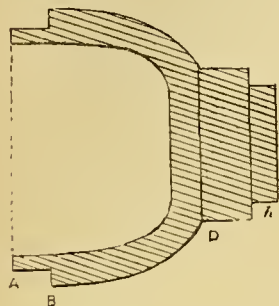


FIG. 4.—SECTION OF LOWER PART OF JAR.

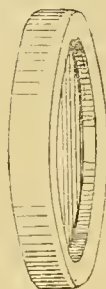


FIG. 3.—SLAB OF WOOD GLUED UNDERNEATH JAR.

tom, and is composed of two pieces, the place where they are joined being about 3 inches from the lower end. The upper piece has its upper end for about  $\frac{1}{2}$  inch in length turned small enough to fit into the hole which was made through the centre of the slab of wood which you have just fitted on to the bottom of the jar. It also has its lower end turned down  $\frac{1}{2}$  inch in diameter for about  $\frac{1}{2}$  inch in length. The lower



FIG. 5.—RINGS OF WOOD GLUED INTO HOLES IN LID.



FIG. 2.—HOLLOW PART OF JAR.

piece of the stem is about 3 inches in diameter, has its bottom turned perfectly flat, and a hole bored in its upper side large enough to contain the end of the upper piece which has been turned down. Both of these pieces should be polished and glued together, but not yet glued on to the jar. The moulding with which they are ornamented can be the same as shown in Fig. 1, or of any other kind which you can devise.

The lid consists of two pieces, the upper one being about twice as long as the lower one, and

fitted on to it in the same manner as the slab of wood was fitted on to the bottom of the jar. The general form of the lower piece is represented by Fig. 4. From A to B, a distance of about  $\frac{3}{4}$  inch, it is turned down so that it will fit loosely inside the top of the jar, and at B it is large enough to project slightly beyond the top of the jar. It is hollowed out from A to D, and the other end is turned down to form a projecting flange, on to which the upper piece fits. Make the sides of this part of the lid as thin as is consistent with rigidity, and with a pencil draw a line right round the middle of the part B to D (Fig. 4), and on this line make six small dots at equal distances apart. You can easily effect this if you have a division plate and index on the mandrel of your lathe, but if not, you must guess the divisions. Then bore holes  $\frac{1}{2}$  inch in diameter through these dots, and turn some little pieces of



FIG. 6.—FEET OF STAND.

wood, the shape of which is shown in Fig. 5, to fit into these holes. These pieces of wood should be  $\frac{1}{2}$  in. in diameter in their narrowest part, and one should be glued into each hole, with its widest part projecting outside the holes. Before glueing these pieces of wood into their places, carefully sandpaper and polish the piece of wood into which they are to be fitted, and remove it from the lathe. Now make the upper part of the lid. This, as will be seen by reference to Fig. 1, tapers off gradually to a point. Chuck a piece of wood of sufficient dimensions on a lathe, and proceed to hollow out the end of it which is furthest from the mandrel, so that it will fit tightly on to the flange which you have made at the upper end of the lower part of the lid. Turn the rest of it into any shape that you please, polish, remove from the lathe, and glue on to the lower part of the lid. A small ivory bead fitted on to the top of the lid would improve the appearance of the jar, the bead being plain turned, or filed, into a hexagonal or any other shape that taste may direct.

We will now turn our attention to the stand. This, as has already been mentioned, is hexagonal in shape, and is supported by six feet.



To make these feet, turn six pieces of wood of the shape shown in Fig. 6, polish one side and the edge, and drill and countersink a hole through the centre of each. Care must be taken that all these feet are exactly of the same thickness, otherwise the jar will not stand upright. Then procure a piece of  $\frac{1}{2}$  inch wood, 9 inches square, and cut it into the shape of a hexagon. This you can easily do by reference to the fifteenth proposition of the fourth book of Euclid's Elements. Procure a piece of walnut wood  $\frac{1}{4}$  inch thick, and large enough to fit on to the top of the hexagon. Plane both sides of it, screw it on to the top of the hexagon, find its centre, and draw on it a circle 5 inches in diameter. Then cut out this circle of wood, and trim up the edges so that they are level with those of the deal hexagon. When you have done this, unscrew the walnut wood hexagon, and glue a piece of plush on to the top of the deal hexagon, and then screw it back again into its place. Procure six strips of thin wood, nail them round the hexagon with small tacks, so that they form its sides, and project about  $\frac{3}{4}$  inch above the top of the walnut wood hexagon. Cover these sides over with the same kind of plush as that which you have previously used. The piece of walnut wood used for the top of the stand need not be plain, but may be fretted or carved into any pattern that you please. Cover over the bottom of the stand with a piece of bookbinder's cloth, and screw one of the feet on to each corner, so that its edge is exactly under the edge of the hexagon. Now turn the six tapering ornaments which are shown fastened at equal distances apart, on the top of the stand, in Fig. 1, and turn the lower end of each  $\frac{1}{4}$  inch in diameter for  $\frac{1}{4}$  inch in length. Bore holes  $\frac{1}{4}$  inch in diameter on the top of the stand, above each of the feet, and firmly glue into each of them one of the turned ornaments. We have now finished the constructive part of the jar, and it only remains for us to fit the various parts of it together. Bore a hole through the centre of the stand, and a similar one in the centre of the bottom of the stem, and screw the stem on to the stand by passing a screw through the hole in the centre of it into the hole in the bottom of the stem. Then care-

fully glue the jar on to the top of the stem, taking care that it is fixed on perfectly level, and the whole jar will be complete.

I have not as yet said why the holes in the lid are made. The jar which I made was intended to hold a mixture of rose-leaves and various sweet-smelling drugs, so I made the holes in the lid to allow the scent which proceeded from them to escape into the room. If you do not construct the jar for this purpose, you can easily leave the holes out, as their absence will not add any detriment to the appearance of the jar. In conclusion, I will say a few words as to the kind of wood out of which the turned parts of the jar should be made. Almost any of the foreign hard woods, such as box, cocus, ebony, tulip, &c., would do very well. Some of our own English woods, such as acacia, apple, pear, damson, would be very suitable, especially the two latter. Pear wood works very nicely with the ordinary soft wood tools, and is especially suitable for articles which have to be hollowed out. I have obtained some very nice specimens of damson wood which have reddish-brown and yellow stripes running along the grain, and light pink markings are frequently interspersed between these. Such specimens of damson wood as this would, when polished, form a very handsome jar.

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FRENCH POLISHING.—A correspondent in the *English Mechanic* says:—I have hit upon an easy dodge for French polishing which no doubt many of your readers will scoff at; but I find it useful. I take an old brush and give my wood a rough rub with the old beeswax and turpentine polish; then rub off all superfluous wax. This acts as a filling, and I find French polish takes admirably over it when the turpentine has dried. I chiefly use it for dark oak, as beeswax polish, by itself, is troublesome and not permanent.

A PERMANENT AND DURABLE JOINT can, it is said, be made between rough cast-iron surfaces by the use of asbestos mixed with sufficient white lead to make a very stiff putty. This will resist any amount of heat, and is unaffected by steam or water.

## AN ELECTRIC ALARM &amp; WATER BOILER.

By S. G. HORTON.

**B**EING of a somewhat lazy disposition, as regards getting up in the morning, I made an adjunct to the bedside, a description of which may interest some of our readers.

Fig. 1 represents the whole apparatus, drawn to  $\frac{1}{4}$  scale.

A is a baseboard, with fillets, B, screwed to underside, to form a hollow space for connections, and C is a covering screwed to the fillets.

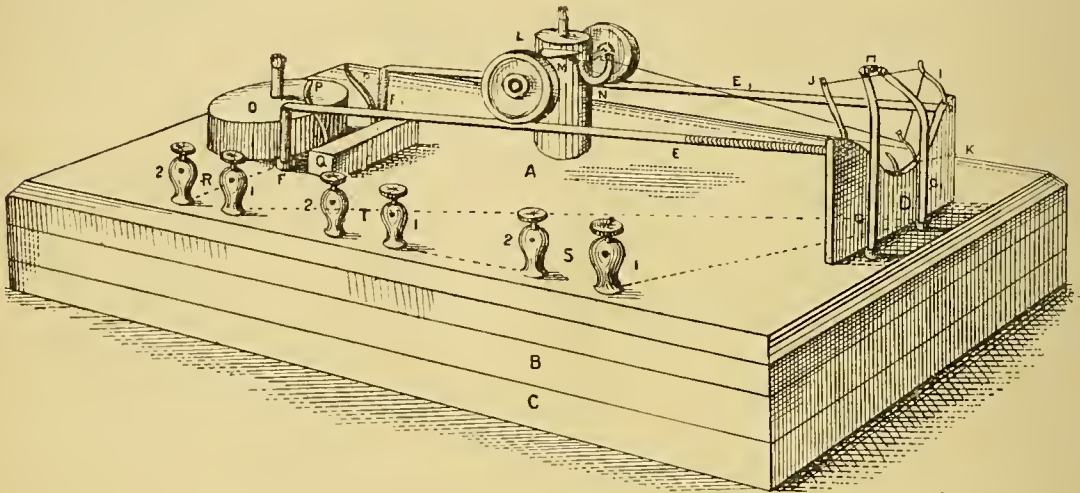


FIG. 1. —APPARATUS COMPLETE (ONE-FOURTH FULL SIZE).

D is a piece of hard wood which supports the two brass rails, E, E<sub>1</sub>, these being soldered at the lower ends to two brass pillars, F, F<sub>1</sub>, which pass through the baseboard and are nutted below. These have shoulders on them, to keep them square and at their correct height.

G, G<sub>1</sub>, are two pillars of brass wire, similarly shouldered and nutted below, and bent in two directions, as shown (see also Fig. 5), bringing their upper ends to within a  $\frac{1}{4}$  inch of each other. These ends are filed flat, and a hole bored and tapped in each for a binding screw. These screws hold the ends of a piece of fine platinum wire, which is wound spirally round a piece of asbestos  $\frac{1}{16}$  inch square and  $\frac{3}{8}$  inch long.

The pillar, G, has a small projecting piece of brass soldered to it just above the top of D.

I is a piece of thinner brass wire driven into D and bent at its upper end.

J is a similar piece, with a fine saw-cut in the end.

K is a hook of the same wire driven into the notch in D.

L is a small travelling lamp, made of  $\frac{3}{8}$  inch brass tube, with a wick-holder soldered into the top, and with an axle soldered to each side near the top, on which two wheels, grooved to fit upon the rails, E, run.

M is a piece of brass soldered to the axle, in such a position that when the lamp, L, is at the top of the incline it just rests on the projection on G.

N is a small wire hook, with a saw-cut in the top.

O is a spirit lamp, sunk into the base A, and of such a height that when the lamp L rests with its axles against the stops P, and its lower end tilted by resting on the block Q, its flame will just light the lamp O.

R are the binding screws to which the bell is attached.

S, the battery binding screws, and

T are screws to which the means of setting the whole in action are connected. This may be either one of the many forms of electric alarm clock already described in *AMATEUR WORK*, or else one of the very handy watches with contact points now sold.

The rail, E, should be coated for an inch or so

at the upper end with collodion, as shown by the shading.

The connections are shown in Fig. 1 by dotted lines and in plan in Fig. 2, the same letters being used to denote the same parts in all the figures.

Fig. 3 is a section (full size) of the rolling lamp, *A* being the body, *B* the wick holder,

through the platinum wire, *H*, which it heats, to the projection on *C*. Thence by the brass piece (*E*) through the axle (*C*) and the wheel (*D*) along the rod, *E*<sub>1</sub> to *F*<sub>1</sub>, thence to the timepiece by *T*<sub>2</sub>, and back to the battery by *T*<sub>1</sub> and *S*<sub>2</sub>.

On the wire *H* being heated to whiteness, the lamp *L* is lighted, and burns the thread, thus

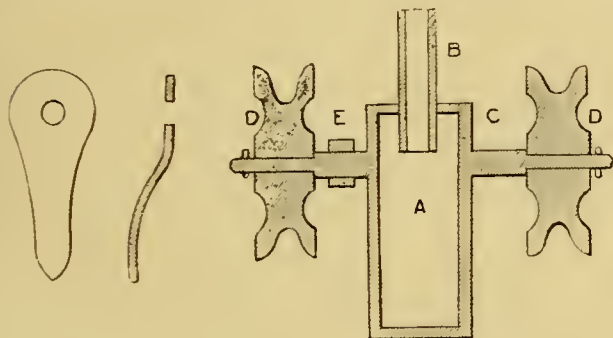


FIG. 4.—BRASS WASHER.

FIG. 3.—SECTION OF ROLLING LAMP (FULL SIZE).

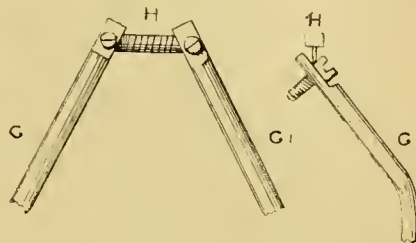
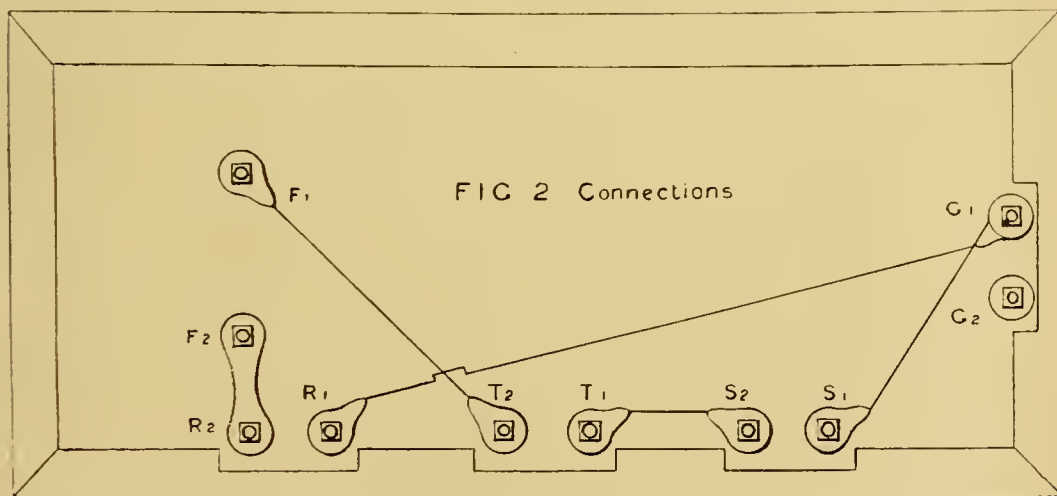


FIG. 5.—ARRANGEMENT FOR HOLDING PLATINUM WIRE AND ASBESTOS.



*C* the axles, *D* the wheels, and *E* the small piece of brass *x*, Fig. 1.

The apparatus works as follows:—

The lamp *L* is filled with paraffin, and *o* with spirits of wine. A piece of cotton thread is slipped into the notch in *x*, and the lamp *L* drawn up to the standards *G*, *G*<sub>1</sub>, so that the wick touches *H*. The thread is passed under *K*, round *I*, and slipped into notch *J*.

On the watch, or clock, making contact at the hour set, the current passes from *S*<sub>1</sub> to *G*<sub>1</sub>, thence

allowing the lamp, *L*, to run down the rails. As it travels, the wheel running on *E* gets off the insulation, and the current, instead of passing by *G*<sub>1</sub>, *G* (*E*), passes across the axle (*C*) to *E*, thence to *F*, and through the bell, by means of *R*<sub>1</sub>, *R*<sub>2</sub>.

On reaching the block *q*, the bottom of the lamp is tilted, and the flame lights the lamp *o*, over which one's pot of shaving-water is placed on a wire tripod.

The bell will ring as long as the contact lasts at the timepiece.



Fig. 4 shows the form of brass washers which are placed under the nuts, and to which the connecting wires are soldered.

I have lately added to my own apparatus a stand for the watch, on the further side of the baseboard, and a small incandescent lamp on the near side, which is connected to the battery wires, with the intervention of a pinch contact at the end of sufficient twin cord to reach my pillow.

As regards battery power, I use either a small three-celled accumulator, or else four low-tension Leclanche cells.

In conclusion, let me hope that my description may enable some of our readers to make a similar apparatus, which will be as useful to them as mine is to me.

## HOME-MADE TOOLS FOR LETTERING AND FINISHING BOOKS.

By FRANK S. MORETON.



DO know how to bind your own books is an art very useful to the amateur. To know how to do it nicely, so that your volume of *AMATEUR WORK* may look well enough to go on the shelf by the side of regularly-bound books, is a cause of much satisfaction, but at the same time is a difficult feat, especially to the beginner. The author of "Bookbinding for Amateurs," in the earlier part of this magazine, went into the question very thoroughly, and his articles were a great help to me, although I had tried my hand many times before I read them. With the aid of his teachings, and the suggestions offered by "An Amateur Binder," as to handy tools, I was able to bind up all my volumes of *AMATEUR WORK* and several other magazines; but the tools for finishing and gilding were so elaborate and expensive, that I was afraid I should not be able to letter and tool them to my satisfaction. So I went to work and made a rough set of tools, which cost next to nothing, but with which I can finish a book nearly as well as I could with the regular tools of the trade.

These tools can be easily made by any amateur who possesses the cheapest kind of a lathe, and who is situated near enough to a printing office to borrow a line or two of type.

Ordinary printer's type are made of too soft material to stand the heat necessary to gild with. They are used for that purpose, to be sure, but an inexperienced person will either melt the type, or not get them hot enough; and if he tried to letter a nice book, ten chances to one he would spoil it.

Get from your printer the letters you wish to use in the style of type that would be appropriate—say, for instance, the words *AMATEUR WORK*. You would want to use the words on separate lines probably, so you must make your marking type on separate bodies. Take a piece of cardboard or stiff paper, and cut it like Fig. 1, and bend the sides and ends up, stick a strip of paper around the corners to hold it together, and when dry fill it with a composition of melted beeswax 18 parts, Venice turpentine 9 parts, and black-lead 1 part. Let it cool gradually, and while it is cooling you can prepare your type. Take the word "AMATEUR," and tie a string around it tightly, and with a piece of smooth wood tap the letters down evenly together. Now dust the face thoroughly with black-lead, using a soft camel-hair brush. Now, if your wax is cool, by the aid of a vice (what amateur does not have a vice of some kind?), press the letters firmly but gently into the wax, and when at a sufficient depth carefully withdraw them again, and you will have a perfect mould. With this mould make an electrotpe by the single-cell process described by Mr. Parker in his article on "Electrotyping for Amateurs," in No. 73, Vol. VII., First Series.

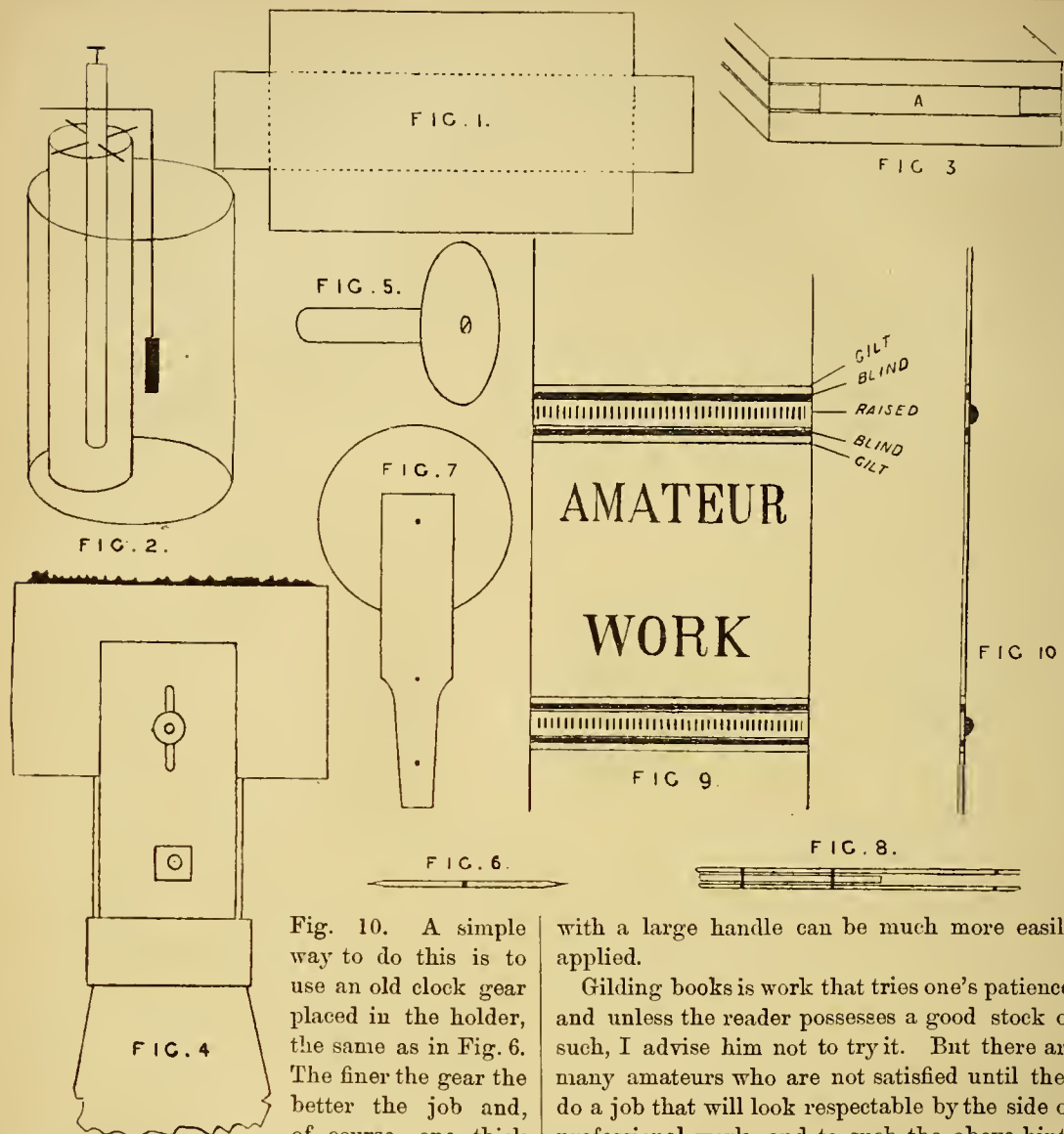
The process is a very simple one, and a good type can be made without much trouble. For those who are not fortunate enough to possess back volumes of *AMATEUR WORK* (benighted creatures!) the process may be described as follows:—Take a glass or earthen jar about 7 inches high and 5 inches in diameter; this will hold about two quarts. If one of convenient size is not handy, one may be easily made out of materials within reach of all. Take a piece of thick pasteboard—millboard, if you have it—of width the same as the height of your jar, and length three times its diameter. See that it is cut true and square. Now roll it around some

circular object, and bring the two ends together. Tie a string around it to keep it in place, and then glue strips of stout cloth over the seam. While it is drying, mark out the bottom with your compasses, and cut out carefully, so that it will fit as tightly as possible inside the circular roll. Press it down evenly, and drive in a few thin tacks to keep it in place. When the glued strips of cloth hold firmly enough to take off the string, cut a strip of common calico long enough to encircle the jar, and wide enough to lap over the ends. Cover this with glue, and roll the box up in it, lapping the top pieces down into it, and the lower pieces over the bottom. After glueing a circular piece of cloth over the bottom, outside, set by the stove to dry, and also put a little paraffin wax on to melt in a tin dish. When both are ready, brush the inside of the box completely over with the hot wax, and turn some in the bottom to the depth of  $\frac{1}{8}$  of an inch, and allow it to cool. This will give you a strong jar, and will hold your battery fluid all right, and answer for many other purposes after you have finished electrotyping. Now take an ordinary porous cup, about half the diameter of the jar, and about the same height, and stand it inside the jar and to one side. Fill the porous cup with water slightly acidulated with sulphuric acid, and the outer one with a saturated solution of blue vitriol or sulphate of copper. Suspend an amalgamated zinc rod in the porous cup by a couple of copper wires through holes in it, and placed across the top of the cup. Suspend the mould, which must be carefully dusted with black-lead *on the face only*, by a stout copper wire bent at right angles, one end being stuck into the wax, and the other put through a hole in the top of the zinc rod. The connection between the wire and wax must be carefully dusted with black-lead, so that the current will deposit on the mould. In about twenty-four hours a good deposit will be found on the mould. Now, if the mould is completely covered with copper, dust some fine copper filings into it to fill up the low places, and then give it another deposit, and repeat until the letters are solid copper. A muslin bag of sulphate of copper must be kept suspended in the outer cell solution to keep up its strength. Fig. 2 shows the cell

with the mould suspended in it. When the electrotype is of sufficient thickness, pull off the wax, trim the edges—a part that must be done carefully—brush the back over with soldering fluid, and then, by the aid of the spirit lamp, melt a thin layer of solder over it. Then form a rough mould out of four pieces of wood, like Fig. 3, fitting the electrotype tightly in the bottom of it at A, face down, and pour in melted lead or type metal—the latter if handy—and your electrotype is finished. Fit it into a handle, and it is ready to do your lettering, and will stand heat enough to set the gold leaf properly. My method of handling them is shown in Fig. 4—the handle being made to fit all the different types, a hole being bored in each to fit the thumb-screw. To some this may seem a more expensive process than buying the regular bookbinder's type; but if they consider that nearly every article used is useful for many other things, and is probably already possessed by the majority of amateurs, it will put it in a different light.

For doing the line work in gilt and blind, I made simple tools out of copper coins 1 inch in diameter. Those having perfectly smooth edges and not milled should be chosen, or pieces of brass may be cut out, only care must be taken to pare the edges smooth. By screwing them to a small piece of hard wood through a hole in the centre, as in Fig. 5, the pieces may be smoothed off and burnished on the edges by putting them in the lathe chuck. Two or three of different widths will be required. If a coin or piece of brass,  $\frac{1}{16}$  inch thick, is used, it need not be turned off for any one size, but for a light line the edges must be turned down, as in Fig. 6. This may be done by holding a fine file against the coin or brass as it revolves in the lathe. The holder may be made, as in Fig. 7, out of two pieces of brass cut to shape, with a third and shorter piece, a little thicker than the wheel, between them, and all riveted together with small pieces of wire. A side view of the pieces as riveted is given in Fig. 8. These should be fitted into appropriate handles.

In Fig. 9 is shown a section of the back of a book tooled with the above tools. The small lines at right angles with the cross lines are made on the raised band which is shown in



enough to go across the band should be chosen. This part may be left out if desired, or the style varied to suit the binder. The style shown in the illustration makes a very neat back, however. I have used these tools on both roan and morocco, and find that they work very successfully, especially on the latter. In putting the tools into handles, it should be borne in mind that they can be used much better in large handles than in small ones. Considerable pressure is needed at times, and

with a large handle can be much more easily applied.

Gilding books is work that tries one's patience, and unless the reader possesses a good stock of such, I advise him not to try it. But there are many amateurs who are not satisfied until they do a job that will look respectable by the side of professional work, and to such the above hints may be useful. With an outfit such as described by "Amateur Binder" in Vol. I., and the above tools, one is entirely independent of the professional binder, and need not go to him for anything except a little stock. The set of tools described above were made to finish a book after the style of some done at a regular binder's, and the imitation was so good that, as they are all placed on the shelf together, one has to look some time before selecting the ones bound by the trade and those by your humble servant.



## A PUZZLE MONEY BOX.

By JAS. SCOTT.

**N**ATURE generally seems to compensate us for any afflictions or deformities she burdens us with, and there are, at this day, dozens of men and women who parade the streets, or—as is more generally the case—

by a cripple, and I believe it was the only one of the kind he made, although ingenious devices of all sorts were continually being executed by his skilful hands. As I believe that was the only one he made, and as I also believe that no one else ever made any, I considered that the AMATEUR WORK perusers might like to know how it was put together; for no doubt there are to be numbered among them a

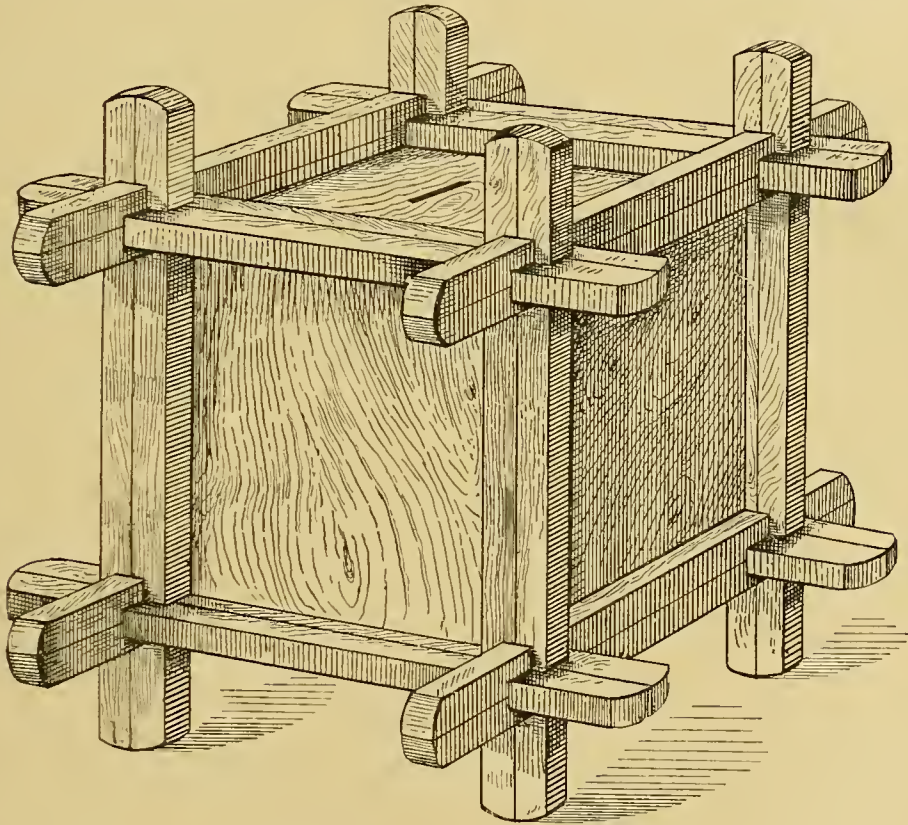


FIG. 1. —THE PUZZLE BOX COMPLETE.

are located at street corners, who are entitled to sympathy on account of their infirmities, and who, in several instances, are very ingenious at making small articles, such as models, pictures, etc. And if enquiry were to be made, I think it would be found that of the many poor afflicted ones who are in a better position, as regards worldly goods, than their brethren, a great number are exceedingly clever.

Until lately, I had in my possession a money box (of which I here give a drawing) made

by a cripple, and I believe it was the only one of the kind he made, although ingenious devices of all sorts were continually being executed by his skilful hands. As I believe that was the only one he made, and as I also believe that no one else ever made any, I considered that the AMATEUR WORK perusers might like to know how it was put together; for no doubt there are to be numbered among them a

host of fathers who would be delighted to give their youngsters something novel and useful, although they may already possess a large stock of toys. The box, as in Fig. 1, is a firm little article, and would stand a lot of knocking about by the small hands, if made in a hard wood to fit nicely together. It will afford some amusement to—as the advertisers say—old and young, in their endeavours to discover where and how it comes apart; and it must be confessed the

drawing has a *very* puzzling look, which would not be lessened in the real article.

It is rather a difficult matter to explain satisfactorily how it is made, but I will do my best.

First, then, I must say that it can be made any size; but that whatever the length of each piece, it must be *square* in thickness. There are twenty-four rails in all. A glance, now and again, at Figs. 2, 3, and 4, while reading the following explanation, will be necessary. No. 1 (Fig. 2) consists of two pieces cut at *both* ends, as in Fig. 4. Wherever the rails are cut in this manner, they must be so fixed that the smaller mortise faces the *inside* of the box. This is how the No. 1 rails have to be placed. Then through

the pair No. 9. The ends of No. 8 are shaped as in Fig. 4. Rails Nos. 10 and 11 (of which the front end of one in each pair is solid) enter No. 9. Now we come to the final pair, one of which is solid the *whole* length; and the pairs Nos. 4 and 7 having been cut as in Fig. 4, the former are permitted to enter them and complete the framework.

Six sides (all the edges of which are bevelled, and one of which has a slot in it) are necessary for the completion of the box. These can be fixed in as the rails are being put together; the manner in which they are held together being better understood then, than either words or diagrams could make them now.

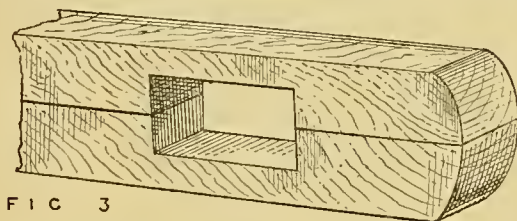


FIG. 3

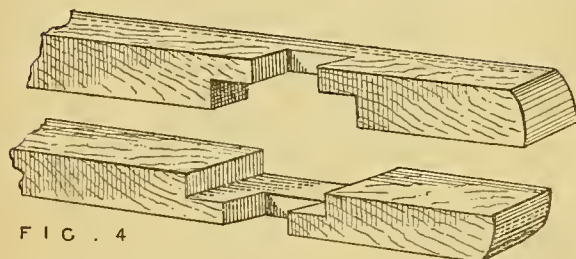


FIG. 4

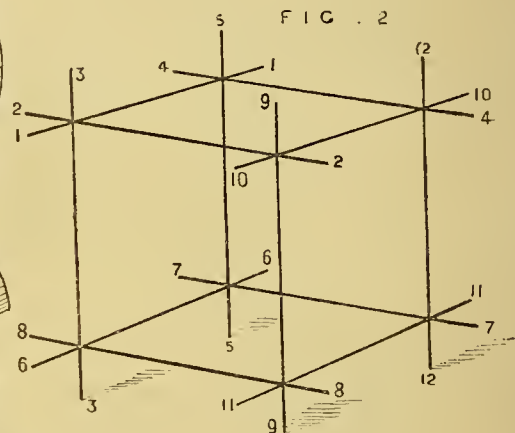


FIG. 2.—SKELETON OF BOX. FIG. 3.—ENDS OF SOME OF THE RAILS. FIG. 4.—ENDS OF OTHER RAILS.

the front end of them are pushed the two rails, Fig. 2; the end that enters No. 1 being as in Fig. 3, and the other end as in Fig. 4. Then, where these join the others, are introduced the rails No. 3, the top end of the inside one being quite solid—no mortise in it. It will be found a comparatively easy matter to join all the rails when building up the box. No. 4 now pass through the further ends of No. 1, then up goes the pair No. 5, the inside one of which is also quite solid at the top end. The bottom ends of Nos. 3 and 5 are treated as in Fig. 4, and through both of these pass the rails No. 6. Now to these are connected the pairs Nos. 7 and 8, one rail in each of which is solid at the end which enters No. 6. Up through Nos. 8 and 2 passes

The best way to proceed will be to mortise nine pairs of rails at *both* ends, and three pairs at *one* end, as in Fig. 3. As they are being joined together my explanation can then be comprehended. No mortise must be cut deeper nor shallower than *half* the thickness of each separate rail.

When complete, none of the joints can be detected, and the rails can only be taken apart by pushing *first* the solid one in No. 12—the pressure on any of the others has no effect otherwise. It will be found very amusing to see the “puzzled one” doing his best to pull the pieces apart; and, simple as it seems, very few indeed dream of pulling the right piece out.



## AMERICAN ORGAN BUILDING.

By THOS. L. WINNETT.

## V.—STOP-BOARD AND FRAME—KEY-SLIP—KEY-BLOCK.



UPPOSING that we next proceed with the stop-board. Figs. 35 and 36 explain how to put the parts together. *A* is the front stop-rail; this must be made of some close-grained hard wood suitable for ebonising; *c* is the back rail, and can be made of ordinary deal; and the same for the part *B*. The size of the stop-holes will greatly depend upon the diameter of the stop-rods, but you will find that they should be rather over  $\frac{1}{2}$  inch, allowing for the bushing. The two sets of holes should be made to correspond by boring together. The part *D* is the only one in which you will find any difficulty. It consists of a piece of ornamental picture-frame moulding, made wider by joining another strip at the back. It is my own idea, as I have never seen it on any American organ, and it certainly gives a very rich appearance to the keys. The kind of moulding we must get is the dull ebonised sort with carvings over it, and enriched perhaps with a gold line; if you can get it in a raised key pattern, the effect is better. Mr. Rees, who advertises in *AMATEUR WORK*, or any picture-frame maker, will, no doubt, supply you with a short length. The under part of the moulding where the rabbet is must be planed off diagonally, so that the rabbet only disappears; also the back part will want to be prepared for the strip of ebonised wood, which is to make up the width to  $2\frac{1}{2}$  inches. The thickness at the back will differ according to the size of moulding obtained, but it must not be less than  $\frac{5}{8}$  inch.

Fig. 35 will help you in the putting of the frame together. Use screws and glue. The part *D* must first be fixed to *A* by screwing from the back; then fasten *A* to *B* by means of dowels; finally put on *c* by screwing from underneath.

The frame will require to be fitted in position on two bearers (*H*, Figs. 34 and 35). For measurements of these bearers please refer to the illustrations. The bearers are fixed firmly on to the top of *key frame*, one at each end, close to the keys, by means of screws running into the frame. When the stop-board is laid on the

bearers, the moulding *D* should be  $\frac{1}{8}$  inch behind the black keys, and raised above the "naturals" a little more than  $\frac{1}{16}$  inch; therefore, the bearers should be planed accordingly. The part cut out of the bearers at *A*, Fig. 34, has to fit into the next part we must make, *i.e.*, key blocks; these are the blocks of wood filling up the space between the keys and sides of case. I have given a sketch of them in Fig. 37, with measurements, but these must not be adhered to rigidly, as the size will differ slightly. Use solid walnut,  $1\frac{5}{8}$  inch thick, at the front edge. Plane up very carefully, keeping the edges quite square and sharp. The blocks are kept in position by fixing in the key frame,  $1\frac{3}{4}$  inch from the front, a  $\frac{3}{8}$  inch wooden stud, projecting up about  $\frac{1}{2}$  inch, fitting into a corresponding hole in the block. A screw out of sight at the rear will keep the whole block secure. In fitting, the top surface of each block must be a shade over  $\frac{1}{16}$  inch higher than the white keys, and the front edge should be in a straight line with the projecting ivory which overhangs the front of keys.

Now for the key-slip, Figs. 38 and 39. This, you will see, is in two parts. The lower part (*c*) is to be fixed permanently to the instrument by *L* irons (*D*) at either end, fastening it to the sides of the case. The top part (*B*) is movable, in order to get at the action. I think you will see the way the parts are put together by looking at Fig. 39. *A* is a narrow strip glued on to the top, to make the width in appearance to 1 inch. *B* is to be fretworked after the style of Fig. 38, or according to the individual taste of the worker. If you do not, as is very likely, possess a fret-saw machine large enough, Mr. A. P. Morrelli (a professional fretcutter), of Cross Street, Leonard Street, E.C., will do the work cheaply and well. *E* is an ornamental moulding, glued on to *B*. The lower part (*c*) should be  $\frac{5}{8}$  inch thick,  $2\frac{1}{2}$  inches deep, and 3 feet 3 inches long. The flutings are made with the hand reeder, chiseling away the lower parts with a sharp chisel, finishing off with a rabbet plane, thus leaving the beads standing above the surface.

Fix in the part *B* two pins, about 6 inches from either end of key-slip. The plated pins used for piano keys are the best things for the purpose.



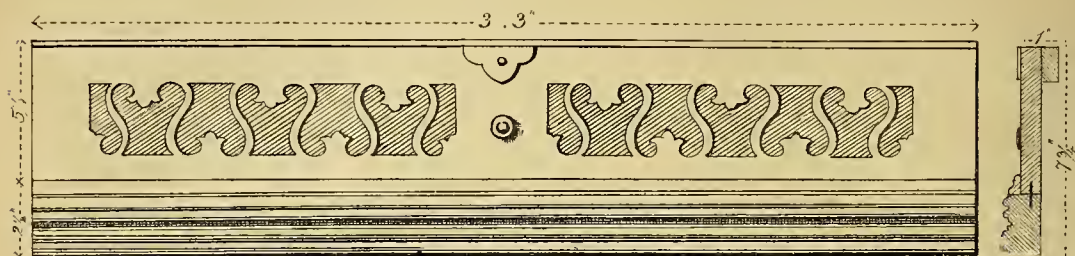


FIG. 38. Key slip 1 1/2 inch to foot

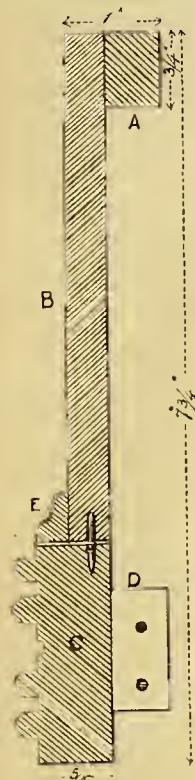


FIG. 39

Section of key slip  
Scale 6 in. to foot

Plan of angle iron  
D  
in Fig. 39

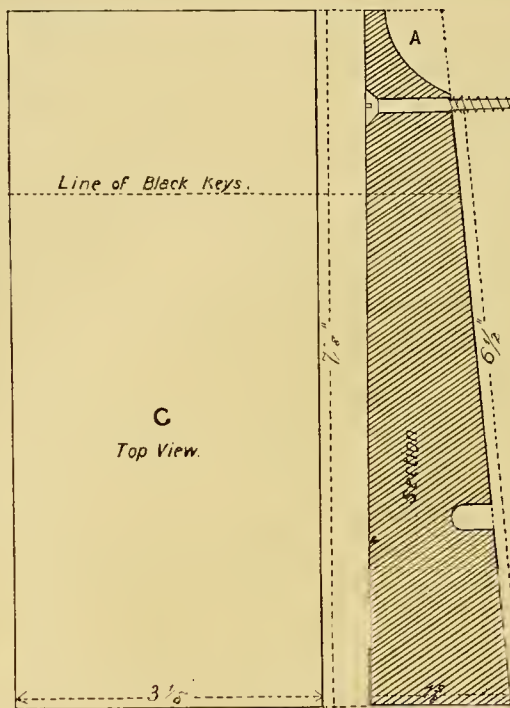


FIG. 37. Key Blocks.

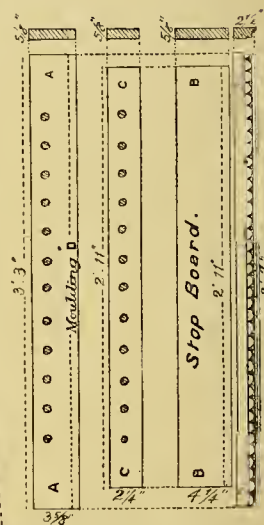


FIG. 36

Stop rails. Stop board  
and Moulding  
Scale 1/4\" to foot

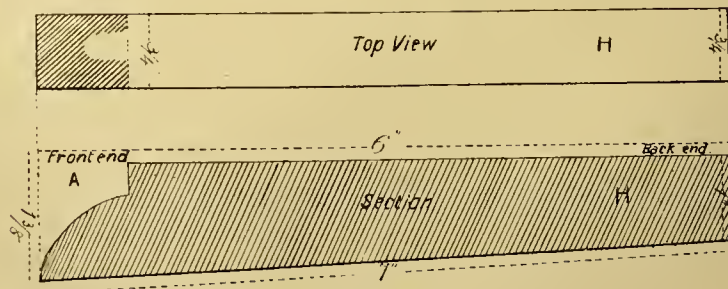
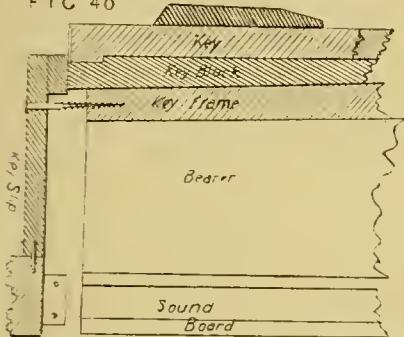


FIG. 34. Stop-frame bearer. Scale 6 in. to foot

They must fit into two holes in part c. The position of the whole key-slip will vary a little, but I will endeavour to give you a guide in placing it. The top edge should be touching the key-blocks at either end, and be just high enough to cover the bottom edge of keys, leaving about  $\frac{1}{16}$  inch for the latter to work in. At the same time the bottom edge must clear the reed board by  $\frac{1}{2}$  inch, that is, a space of  $\frac{1}{2}$  inch must be left between the reed board and key-slip in order that the

FIG 40



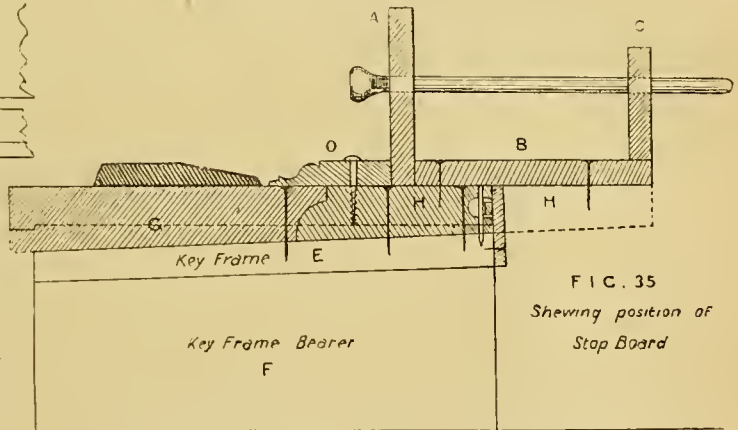
knee-swell action may have room to work (see Fig. 40). The upper part of key-slip must be attached to the key frame by two roundheaded screws about 2 inches from each end, the fixing being facilitated by adding two small blocks to the key frame, where the screws are to come, so as to bring the key frame close up to the key-slip. If you can get the screws with silver plated heads, they will look very nice. In fact, all the screws outside the instrument may be plated with advantage. I sent mine, after I had finished the instrument, to Sills and Co., bicycle platers, Coventry, and they plated the screws for a small charge. Send duplicate screws to the ones you have used in the putting together, as the constant screwing and unscrewing before completion would somewhat damage their appearance. You can by this plan replace the old screws with the silver-plated ones.

Before closing this chapter, I should like to say that if any reader would care to have the full-size pattern of the fretwork of key-slip, Fig. 38, I shall be pleased to post him a copy, upon his sending to the Editor a stamped envelope.

## A MODIFIED "COSTER" CART.

By A. SAVIL.

**T**HIS cart will be found useful by many who have distant marketing to do. It is also a capital cart for luggage, and though not moant to carry more than two persons, will accommodate any amount of parcels, and a child or two may also be easily stowed away snugly at the back. The trap possesses a great advantage in being very easily balanced, for no matter what the cargo may be, the seat can be adjusted at any point along the top of the body, so that there shall be neither too much or too little weight upon the back of the animal, whether mule, "moke," or pouy.



A.—FRONT STOP RAIL.  
C.—BACK STOP RAIL.  
B.—STOP BOARD.  
D.—MOULDING.

E.—KEY FRAME.  
F.—KEY FRAME BEARER.  
G.—KEY BLOCKS.  
H.—STOP FRAME BEARER.

We shall begin our work of building by getting the shafts and crossbars together, as shown at Fig. 2. The shafts should be of ash, and if home-made the worker should choose stuff of a suitable grain, as it is quite possible often to hit upon a piece of timber with a curve which can be turned to account in shaft-making. Otherwise we must have recourse to steaming, which is a job beyond the reach of ordinary amateurs, and in this case it will be just as well to buy the shafts at the timber yard.

My experience is that shafts are generally 12 feet long in the rough; and in the present instance this will suit, as the shafts of our cart are, in or about, 11 feet long, finished work.

I have represented the shafts as bent laterally

only, but should the builder prefer to have them also curved, in what we shall call, for want of a better term, an up and down direction, it will, of course, make no difference with regard to these directions.

The shafts should be about  $2\frac{1}{2}$  inches wide by  $2\frac{1}{2}$  or 2 inches deep, and for this vehicle should not begin to taper until within  $2\frac{1}{2}$  feet of the points. The distance between the back and front crossbars is exactly 5 feet, and from the front crossbar, or transom, to the points, also 5 feet. Each crossbar is  $2\frac{1}{2}$  inches wide, and the tailpiece behind the hind crossbar may be about 7 inches long, which accounts for the 11 feet, or full length of shafts required.

Having procured the shafts, the first thing will be to get them in position temporarily, in order to see that they have the proper bend, and to make the necessary measurements.

Place the shafts so that the straight parts may be parallel, and 3 feet between the outside edges. Tack them in this position by means of three light battens nailed underneath, one across the points, one at the back, and the third about the middle.

The length of the shafts may now be settled, and also the question whether the points are the right distance apart, *i.e.*, from 18 inches to 20 inches at the narrowest, which should be about 16 inches from the front ends, as indicated by dotted line, Fig. 2. Here the stops are eventually to be placed, and from this point the shafts should bend outwards, in order to clear the collar when working. Having marked this narrowest point and measured off the 16 inches, any overlength may now be cut off, and the length of shafts, from the points to the front crossbar, marked.

The two crossbars should next be got ready. These are to be of good straight-grained ash, about 3 feet 7 inches long and  $2\frac{1}{2}$  inches square. They are secured to the shafts by a tenon  $\frac{1}{2}$  inch deep, cut to fit the shaft exactly, and the iron clips, Fig. 3, which are of best Swedish iron. The method of fixing the crossbars and clips will be found fully explained in a former article in this magazine, to be found in Parts 74 and 75, Old Series, to which, in order to save space, I beg to refer my readers.

When the crossbars have been fitted, the shafts should be "dressed" with a spokeshave and smoothing-plane, slightly rounding the upper corners from immediately in front of the crossbar to within about 2 feet of the points, when they may be more rounded upon the upper sides and finally made quite round from about 4 or 5 inches from the extreme points.

The shafts will require strengthening by a plate of iron, say 2 inches wide, 3-16 inch thick, and 3 feet long, placed under each shaft, and reaching 18 inches in front, and therefore the same distance behind the front crossbar.

These plates should be bored for bolts and screws in the following way:—One  $\frac{3}{8}$ -inch hole at each end, for two 3 inch  $\times$   $\frac{3}{8}$ -inch bolts to pass through the shaft, and screw-holes at intervals of about 3 inches in a zig-zag position, and countersunk for stout inch screws; both plates and shafts should have a rather thick coat of priming paint (white lead, lampblack, and oil) before fixing up.

The tail-pieces, or overlengths, of shafts behind the hind crossbar may be rounded and chamfered at the ends, or otherwise finished according to the taste of the builder.

We next come to the construction of the body of the cart. The perspective sketch, Fig. 4, will give the reader a good idea of what he requires to make, while Figs. 5, 6, and 7 give details of the shape and dimensions of the sides, back board and front, or footboard. These should be of elm or birch, and the wood should be of sufficient substance to allow of being fully an inch thick when finished.

Having cut out the sides, etc., according to the dimensions given—of course allowing a small margin for trimming up, get out the two sides, Fig. 5, square and true all edges to exact measurement, and then clean and finish the surface with the scraper and sandpaper.

Should there be any knots or twists in the grain, which render the cleaning up difficult, use a very sharp jack plane across the grain, and finish with a closely-set smoothing plane.

Next prepare Figs. 6 and 7 in the same way as regards the surface, but note that the upper and lower edges of Fig. 6 are to be bevelled to suit the angle—115 degrees—at which the back



of the body is pitched, also that the upper edge of Fig. 7 is rounded and the lower edge square, whilst the ends of both back and front boards are rounded; these latter being intended to project about  $\frac{1}{4}$  inch beyond the sides, and with the ends of the flooring boards—to be described presently—to form a bead upon three sides of the body.

Great care will be necessary in putting these sides, etc., together, and a few temporary stays tacked across the top and bottom will greatly help the worker. The sides should be placed in position, *i.e.*, 2 feet  $11\frac{1}{2}$  inches between the outside edges, exactly parallel to each, and perpendicular. A good floor, or other large flat surface, is essential in body making.

Having stayed or otherwise secured the sides in position, the tail-board and front-board are to be fixed with  $2\frac{1}{2}$  inch screws, the heads being rather deeply countersunk; these countersinkings to be afterwards filled with suitably coloured, hard-drying putty.

The holes should be very carefully bored, and the joint and, also, the screws before insertion should have a rub of priming colour; this, however, must be done so that no paint shall appear, as it is intended to varnish the trap. This direction applies also to all those joints, etc., in which paint is used. There should be at least six screws to each side at the back, and four to each side of the front-board.

The bottom of the body may be of red deal, or even good white deal, and the wood should be chosen free from knots, and well dried. Inch stuff of any width will suit; but assuming that 9-inch boards are employed, we will require seven pieces a "shade" over 3 feet long, which, allowing for squaring and trueing up, will just fill in the space required, 5 feet.

These flooring boards should be well jointed and of even thickness throughout, and are to be fixed as tightly and as closely as possible, using at least four  $2\frac{1}{2}$  inch screws to each end of each board, and applying a good coat of priming—which should be rich in white lead—to the joints.

When all the boards are fixed, they are to be "stitched" together with good wrought iron "battens," making four or five stitches in

each joint, and punching in the heads of the battens.

Now go over both sides of the floor with the smoothing plane to remove all unevenness, and, if all has gone well, we should have a strong, and perfectly rigid body. The ends of the back, front, and flooring boards will now require to be rounded to form the projecting bead before alluded to, and this is best done by means of an American pattern bull-nose plane; but if this is not available, other means will suggest themselves to the worker.

Although, as before observed, the body is strong and rigid, it will need further strengthening in order to bear the strain and the wear and tear of use. Therefore it will be necessary to bind the corners with angle straps of  $\frac{1}{4}$  inch iron, about  $2\frac{1}{2}$  inches wide; each arm to be about 8 inches long, and attached to the body by four stout inch screws. These straps should be placed, say, 2 inches from the top of the body, and in the case of the back corners they will have to be made to suit the pitch of the tail-board.

It will also be necessary to have a strong iron stay, which shall run across the bottom and up each side to within about 2 inches of the top, to be placed in the centre of the body. This should be of iron  $\frac{1}{2}$  inch thick and  $1\frac{1}{2}$  inches wide, and is to be secured by ten 2 inch by  $\frac{3}{8}$  inch bolts—three bolts through each side, and four through the floor, the heads of the bolts to be on the outside of the sides and upon the inside of the floor, and each fastened up with a suitable washer, cutting off all over-lengths with a hack saw.

The next item is the rustic pattern rail which is to supplement the height of the sides.

Ash will be most suitable for this, and we require two pieces 3 feet long by  $1\frac{1}{2}$  inches by 1 inch, shaped as indicated at Fig. 8. Also six pieces same shape but 14 inches long, Fig. 9.

The rail is put together, as shown at Fig. 1, by means of bolts  $2\frac{1}{2}$  inches by  $\frac{1}{4}$  inch, heads on outside, and fastened with suitable washers. I need only point out that the height of the rail above the side is 6 inches, which therefore leaves 8 inches for attachment to the body.

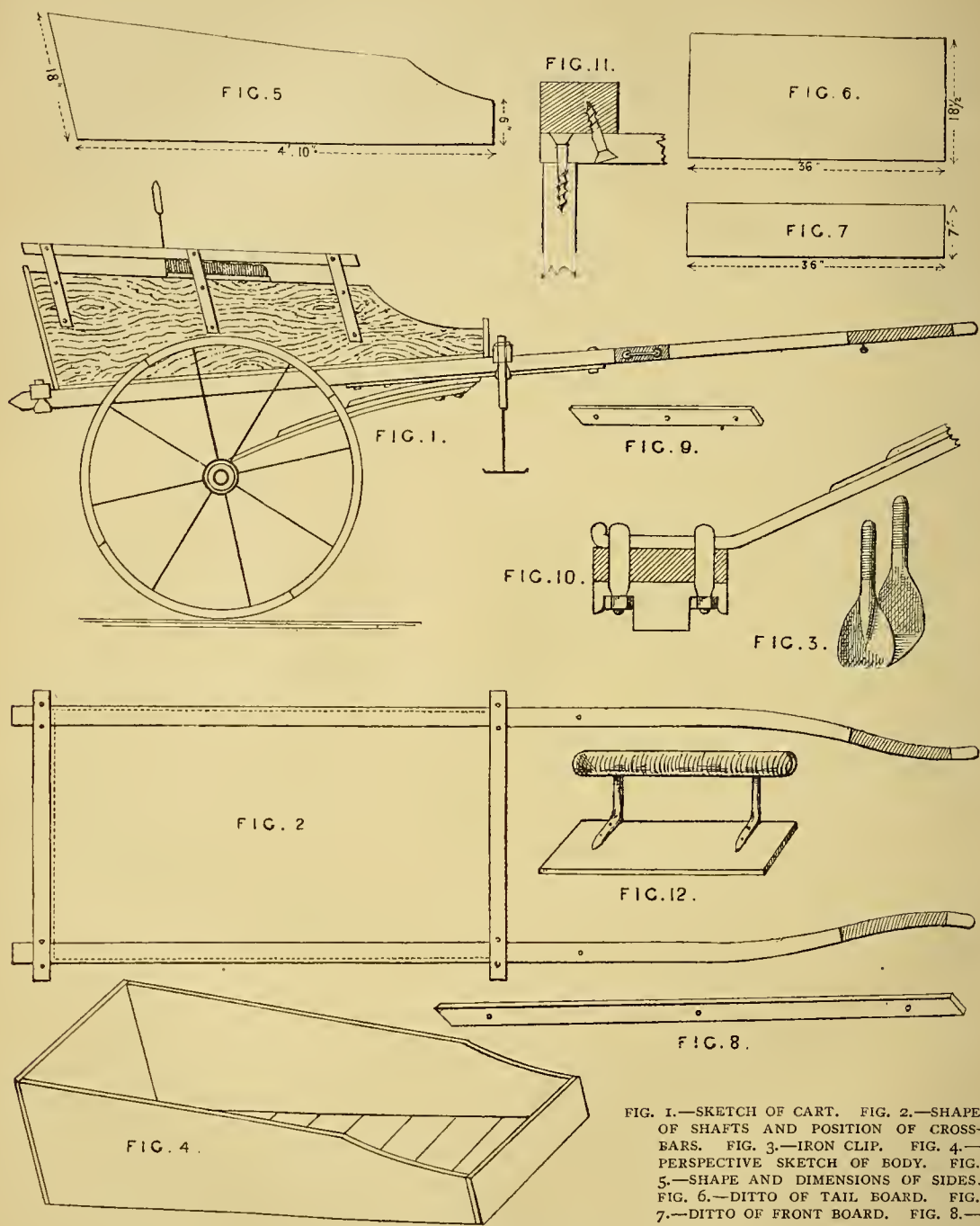


FIG. 1.—SKETCH OF CART. FIG. 2.—SHAPE OF SHAFTS AND POSITION OF CROSS-BARS. FIG. 3.—IRON CLIP. FIG. 4.—PERSPECTIVE SKETCH OF BODY. FIG. 5.—SHAPE AND DIMENSIONS OF SIDES. FIG. 6.—DITTO OF TAIL BOARD. FIG. 7.—DITTO OF FRONT BOARD. FIG. 8.—TOP RAIL. FIG. 9.—SUPPORTING RAILS FOR TOP RAIL. FIG. 10.—MODE OF FIXING SPRING. FIG. 11.—MODE OF SECURING BODY TO SHAFTS. FIG. 12.—MOVABLE SEAT.

*Figs. 1, 2, 4, 5, 6, 7, and 12 are 3/4-inch scale; Figs. 8 and 9 are inch scale; Figs. 10 and 11 are 2-inch scale.*

The body, being now completed, should have a coat of priming on the inside, both floor and sides and on bottom, when it may be laid aside for the present.

We now come to the important subject of springs, axle and wheels.

Should the builder be "up to" the work, and have energy and time enough at his disposal, he can, of course, make the wheels himself; but my belief is that no amateur can make a wheel, and that it is waste of time and money to try. Wheels of every kind may be purchased, and if they are procured unpainted there is no danger, as they may be examined, and any unsoundness, or flaw, detected at once. (See remarks under this head in Part 75, before alluded to.)

For this cart a light wheel of about 40 inches diameter will be required, which should be shod with  $\frac{1}{2}$  inch tyre, of either square or oval section, according to fancy.

The pattern of spring represented at Fig. 1 is often used for this style of cart, and the method of fixing will be apparent on reference to Figs. 1 and 10.

Should the builder prefer another shape, or should there be any difficulty in obtaining this pattern, elliptic springs will suit, and may be obtained almost anywhere.

For this cart a four-plate elliptic spring, about 30 inches long and, say, 10 inches compass, will be best adapted.

The position of these springs should be, in the present instance, about 4 or 5 inches behind the centre point of the body of the cart, *i.e.*, 24 inches from the back crossbar.

The axle should be of the ordinary "mail" pattern, and  $1\frac{1}{4}$  inches in diameter. I strongly recommend the solid flap axle as most serviceable and generally satisfactory.

For the method of determining the length at which the axle is to be "closed," and also for directions with regard to steps, &c., here omitted, I must again refer my readers to Parts 74 and 75, and remind them that all back parts of this magazine may be obtained from the publishers.

Assuming that the foregoing instructions have been followed, we are now ready to fix the body in position as represented at Fig. 1, and it

will be found that it exactly fits between the two crossbars and the dotted lines Fig. 2; while the bead formed by the ends of the flooring boards is flush with the outer edges of the shafts. The method of securing the body is shown at Fig. 11. There should be two  $2\frac{1}{4}$  inch screws to each flooring board, the holes to be bored at an angle as indicated, and the screw-heads countersunk.

The movable seat, Fig. 12, is 3 feet long and about 15 inches wide, by about  $1\frac{1}{8}$  inches thick. The brackets which support the back rest may be of flat iron  $1\frac{1}{4}$  inches by  $\frac{1}{4}$  or  $\frac{3}{8}$  inches. The back rest should be about 14 inches from the seat, and is composed of a piece of inch stuff, say, 5 inches wide and 2 feet 9 inches long. It is secured to the front of the brackets by two small bolts, and may be upholstered with any available stuffing and American cloth, &c. The portion of the brackets which is attached to the seat should be about 10 inches long, fixed to the seat by three small bolts through each, thus giving strength to the seat and ensuring that it shall not warp. This seat may be supplied with two bent "spud" hooks to fit into corresponding holes in narrow plates attached to the upper edge of the sides. (See Figs. 12-15, folding sheet, Part 74.)

The inside and bottom of the cart should be painted some light brown or drab shade, of which it should receive at least two coats besides the priming coat. All other parts of the woodwork will look best varnished. Give three or four coats of good carriage varnish, rubbing down each coat, except the final one, with finest pumice and water, as fully described at page 166, Vol. VII., Old Series, where full directions as to the fittings required for shafts and other items of finishing will also be found.

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**STICKING VELVET TO WOOD.**—Glue may be used by putting it on the wood and not on the textile; but a better adhesive still for the purpose is varnish, as it is sure not to be too liquid, and it only requires a thin layer. If glue be used, it is troublesome, without experience, to get it just the right stiffness. Varnish is used for lining instrument cases.



## MY PARLOUR MANTELPIECE.

By ALEXANDER MARTIN.

*(For Illustrations see Folding Sheet presented with this Part.)*

OR some considerable time back my parlour mantelpiece had been giving me some concern. I did not like it. That was the plain, unvarnished truth; and as my dislike was increasing slowly but surely, one fine morning I set myself down to think what could be done in the matter. So that my readers may follow me, let me explain the appearance of the said mantelpiece before operations were commenced.

When the house was built, the proprietor did not—as some enterprising proprietors do now—put in a smart wood chimneypiece in the best room; oh, no! he put in what was cheapest. It was certainly cheap—and nasty as well, as a matter of course. Made of white wood, it was painted black and varnished. There was actually one moulding in the whole affair, and that was in the shape of a neck moulding mitred round the jambs. All else was plain square work, and the whole thing was a dull, dead, uninteresting sight. Above this mantelpiece was placed, after the manner of twenty years ago, one of those common German gilt mirrors, standing on two white balls for feet; and the combined appearance of the mantel and mirror was somewhat after sketch in Fig. 13. Such was the mantelpiece that I did not like.

It was an easy matter to relegate the gilt mirror to a less important room, leaving the place clear for a mirror more in keeping with present good taste; but it was not so easy to make the mantel itself respectable. I did not want to tear it down and put up a new one—the cost, not to speak of the worry and bother, prohibited that; but I wanted it to be in keeping with the kind of overmantel I intended to make for it. At last I saw my way clear. By taking off some parts and adding others to the existing mantel, I could get what I wanted without a very large outlay of money or of labour. A glance at Fig. 1, of which Fig. 2 is the end view, will give my readers an idea of the success of my endeavours after the beautiful; for in these

figures is shown my old mantelpiece with the addition of an overmantel in place of the old gilt mirror, and it now appears as an important feature in my parlour—a feature I am in nowise ashamed of, no matter who deigns to honour my humble abode.

To attain this end, however, I had a few days' work before me. First of all, I took the base blocks and neck mouldings off the pilasters. Then I had to scrape the black paint, and varnish all off. This had to be very cleanly done on the faces of the pilasters and frieze, as well as the front and end edges of the mantelshelf; for all these parts were afterwards exposed, and had to be stained along with new white wood. Then come the additions to the old mantelpiece. A moulding—see that marked A in Fig. 16, which is drawn full size—is prepared and sprigged in under the shelf, and is mitred round the jambs. This gives the bed moulding; then the neck, or frieze moulding—as shown in Fig. 17, also drawn full size—is prepared and sprigged on round the jambs in the same way, leaving a clear space of  $7\frac{1}{2}$  inches from the bed moulding. This space of  $7\frac{1}{2}$  inches will vary in different chimneypieces, as it is regulated by the depth of the old frieze; you must do as you can in such a case. The base, 7 inches broad by  $\frac{7}{8}$  inch thick, is prepared, moulded on top edge, as shown in Fig. 18—drawn full size—and mitred round the jambs close to the floor. Both sides of the jambs have a piece sprigged on them  $\frac{3}{8}$  inch thick all the way up. Then I required for my mantelpiece about 30 feet of wood  $1\frac{3}{8}$  inches by  $\frac{3}{8}$  inches; the quantity would vary with the size of the mantel. This wood is to mitre on the face of jambs and frieze to form the panels, and is all moulded on one edge, as shown at B, Fig. 16, full size. The 30 feet might be made up of ten pieces, each 3 feet long, and would come in conveniently with the sizes required. In Fig. 14 is shown a small sketch of the section of old jamb before anything had been done; in Fig. 15 is shown the same jamb with the various pieces put on. The hatched, or crossed, parts in Fig. 15 show the new work; the uncrossed part the old. The ornaments in the frieze are then prepared; the shields are taken out of  $\frac{1}{2}$  inch wood, shaped as in Fig. 10, drawn full size, the dotted line being the

centre line, and bevelled off at each side until only  $\frac{1}{8}$  inch thick—see section in centre of shield. These are sprigged into the centre of the two corner panels. The centre ornament is shown in Fig. 11, where again, to save room the half only is drawn, the dotted line being the central line. This half is drawn full size; the ornament is  $\frac{1}{4}$  inch thick, and has a  $\frac{3}{4}$  inch hole bored in its centre by means of the brace and bit. Above the old mantelshelf or top I then place another top  $\frac{7}{8}$  inch thick, and it just projects over the old top sufficient to work an ogee moulding on it clear of the old shelf—see Fig. 19, which is drawn full size, and where c is the new top, with ogee on face and ends, and v is the old top, through from under which the new top is fastened with screws.

The mantel being complete, the mirror or over-mantel comes next. First of all, a frame is made as shown in Fig. 20, drawn to same scale as Fig. 1, or  $\frac{1}{12}$  real size. All the pieces in this frame are  $\frac{3}{4}$  inch thick, the various breadths being as follows:—

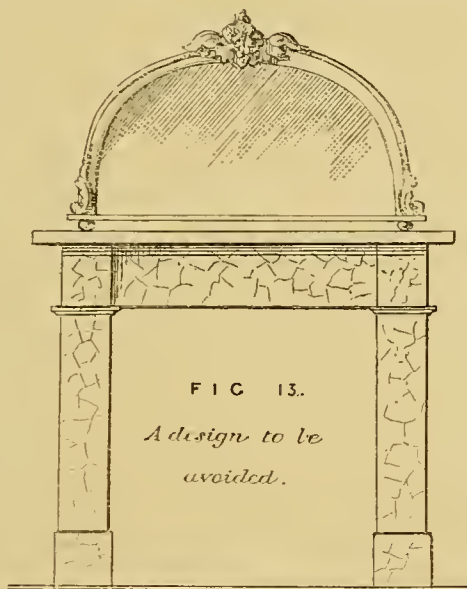
|                                   |                                   |
|-----------------------------------|-----------------------------------|
| G .. $2\frac{1}{2}$ inches broad. | J .. $6\frac{3}{4}$ inches broad. |
| H .. $2\frac{3}{4}$ " "           | K .. $\frac{5}{8}$ " "            |
| I .. $3\frac{1}{4}$ " "           | M .. 1 " "                        |

These various pieces are shown in their connections with other pieces in Figs. 3, 4, 5, 6, 7, and 8, some drawn full size, and some half full size. This frame receives on itself all the other parts, and is, as it were, the skeleton which it is now our duty to clothe. For strength's sake, all the joints should be morticed and tenoned, with the exception of the piece m, which may be simply screwed to g, as it does not affect the stability of the frame. The two outer posts, g, are also only  $1\frac{1}{2}$  inch broad at the top, where they are to be shaped, as will afterwards be described. The base moulding l—Fig. 6, half full size—is planted on the bottom rail n, and mitred round the outer posts g, continuing it for  $\frac{1}{2}$  inch or so

beyond the back surface of g, which will afterwards be trimmed off. The posts g then get a piece  $1\frac{1}{2}$  inch by  $\frac{1}{2}$  inch planted on them all their length; the two outer ones are shaped at the top—as shown in Fig. 7, drawn full size—and the top end of frame should be shaped in exactly the same way. The two centre posts run right up to where the cornice begins, for this cornice is planted on the frame too. The mouldings round the glasses are sprigged on; those on the two

side mirrors are formed of pieces  $1\frac{3}{8}$  inch by  $\frac{3}{8}$  inch, with a  $\frac{3}{8}$  inch ogee on the edge—see Fig. 4, drawn full size; and those round the centre glass are  $1\frac{5}{8}$  inch by  $\frac{3}{8}$  inch, with a  $\frac{5}{8}$  inch ogee on the edge—see Fig. 3, drawn full size also. Each of the glasses has a moulding along top and bottom, exactly similar to that on the sides. The ornamentation above the side mirrors consists of two square spindles,  $\frac{1}{2}$  inch square, and a shaped piece—half of which is given in Fig. 12, drawn full size—taken out of  $\frac{1}{2}$  inch stuff. This, as well as the square spindles, are

half checked into the rails i and k from behind—see Fig. 8, drawn half full size. The two shelves, one above each of the side mirrors, are supported on two brackets each, and are shaped on their one side—as sketch Fig. 21—so that they may rest on the top of the glass moulding. Their fronts and ends are moulded—as shown just above Fig. 9—with an ogee. The supporting brackets are  $\frac{5}{8}$  inch thick, and are shaped as shown in Fig. 9, drawn full size. Both shelves and brackets are fastened from behind with screws, and a sprig through the shelf from above, into the bracket near the front edge, will fix all together. The posts, g, must have a piece about  $\frac{1}{4}$  inch thick put on behind, exactly where the other pieces  $\frac{1}{2}$  inch thick were put on in front; these are necessary to form a check for the back boards to the glasses. In

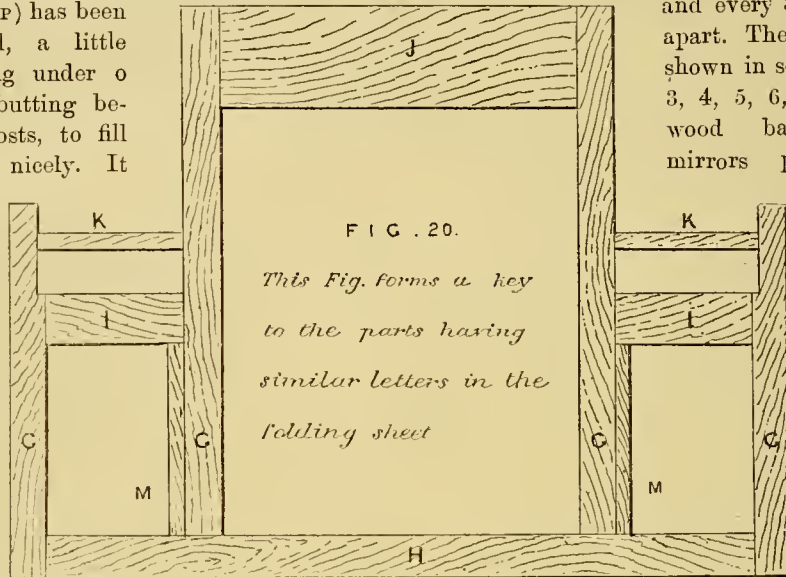


Figs. 3 and 4 are shown these back pieces—see N. The cornice is then built on. A section of the complete frieze and cornice is given—half full size—in Fig. 5, where J is the original or skeleton frame. The moulding o is put on, just leaving enough room for the top rail to receive the dentil r above it. After o is mitred round the posts, r is prepared; the dentils on the face of r should be  $\frac{5}{8}$  inch wide,  $\frac{1}{4}$  inch apart, and  $\frac{3}{8}$  inch deep. The depth is shown by a dotted line across p. After this member (p) has been mitred round, a little ogee moulding under o is required, butting between the posts, to fill up the corner nicely. It

varnish, rubbed it well with sandpaper, and gave it another coat of varnish. This brought up the shine very easily.

I put plain glass in the overmantel; but I am now very sorry that I did not put in bevelled glasses, as they are so very much nicer, although they are, of course, more expensive. The plain ones cost me 12s., and if bevelled they would have cost about 24s. for the three. The glasses are fixed in with little blocks about 2 inches long,

and every 3 inches or so apart. These blocks are shown in section in Figs. 3, 4, 5, 6, and 8. The wood backs to the mirrors prevent them



appears also as part of the cornice. A similar moulding, but with a band 1 inch wide, is planted immediately above the glass moulding; and against this broad band is planted a frieze moulding, which is mitred round the posts. This is also shown in Fig. 5, drawn half full size. Then the topmost member of the cornice (q),  $3\frac{1}{4}$  inch by  $\frac{5}{8}$  inch, is moulded on front and ends, and is fastened down over all. The backs for the mirrors are then prepared ready for fastening on.

I then had to stain my work. I got some dry brown colour in powder, mixed it well up with water, and applied it all over everything—previously, however, removing the shelves and brackets, as they would just have been in the way. I applied the stain as equally as possible, rubbing it off where it appeared too thick, etc.; and when dry I gave it a coat of clear spirit

being damaged in any way, by damp or otherwise.

The mantel was fixed to the wall all right, but the overmantel had to be fixed to dooks let into the wall.

This completed my work. I had an idea that a pediment of some sort above the cornice would be an improvement, but when I got some jars and ornaments set on the shelves, and a plate and a couple of Japanese fans on the top of the cornice, I was thoroughly content as it was, and I think it better, therefore, without any pediment. I was glad when I had it completed; but I cannot express the joy and satisfaction I felt when I beheld the happy result of my labours.

If I have not been sufficiently explicit on any matter of detail, I shall always be at the reader's disposal through the medium of "Amateurs in Council."



## PHOTOGRAPHIC PRINTING PROCESSES.

*By A PRINTER.*

I.—SILVER PRINTING ON ALBUMENIZED PAPER—SELECTING THE PAPER—SINGLE AND DOUBLE ALBUMENIZED PAPERS—SENSITIZING BATH—SENSITIZING THE PAPER—METHOD OF PRESERVING SENSITIZED PAPERS—MATT SURFACE, OR PLAIN SENSITIZED PAPERS, AND HOW TO PREPARE THEM.



It is nowadays widely asserted that photography has become so simplified that anyone, from a child upwards, can now take photographs, and turn out decent pictures to their heart's content. But, alas! how soon the novice, just starting on photographic practice, finds himself disillusioned on this point. For instance, what requires greater brain-power and common-sense judgment than to learn the secret of giving correct exposures and developing the plate to that degree of nicety which will ensure a negative with plenty of detail and of the correct density for turning out good prints? All those who have handled this subject know the months of hard work, of study and practice, necessary to become an adept in this branch of the photographic art, especially if there is no old hand available to point out and rectify mistakes, and the learner has to rely on his weekly journal and a few text-books for the whole of his instruction. However, I intend to leave "negative-making" alone for the present, as it has been so much written about lately, and, instead, give plain and practical instructions in the various methods of photographic printing, giving special prominence to the new and fashionable processes of the present day.

I have not the slightest doubt but that some sound practical instruction on these matters, by an old worker, will prove of immense benefit to the beginner. True it is that chapters on printing and kindred processes are given in most text-books, but they are generally so scanty in instructive matter as to be of but little use to the novice; but when we give our sole attention to printing matters alone, it is then possible to go more extensively into every detail and every process. A great many people are apt to think that once a good negative is secured all the rest comes quite easy. I assure my readers it does

not; nothing requires greater taste and skill than printing in silver on albumenized paper, and the same is equally true of every other method of printing. Again, toning, fixing, trimming, mounting, spotting, burnishing or rolling, and every little detail incidental to the work, even to brushing the mountant on the back of a print, can only be accomplished satisfactorily by plenty of practice, practice, practice.

I can well remember that I failed in every branch, and many times over, and shudder to think of the monstrosities that were turned out, especially in the portrait line. But I have no wish to discourage the photographic aspirant, neither do I wish to deceive him, hence my warning; and in concluding these few prefatory remarks, I would also add that if a man wishes to take up photography, he must have no other hobby, for if he wishes to turn out decent work it will take the whole of his spare time and considerably more than his spare cash. It is often said that photography, especially amateur photography, means never-ending expenditure; and this, unfortunately, is only too true, and is the greatest objection many have to pursuing an otherwise very delightful and instructive art. Nevertheless, if we keep to half-plate, we may, with strict retrenchment, keep within reasonable bounds.

*Silver Printing on Albumenized Paper.*—This is the oldest and still the most used of present-day printing processes, so I naturally take it in hand at once. As most of my readers know, Saxe and Rive's paper is used in this process, and it is albumenized by the wholesale paper houses, and supplied in this form to the photographic dealers and professional photographers, both of whom sensitize it in the ordinary way. These papers are both sized with starch. Saxe, however, is the more porous of the two, and is therefore less glossy, but it is much the toughest, and will therefore stand more handling during the various washings; in fact, it is always used for large prints. Where great gloss is required in small work, such as portraits, Rive's paper is used; but this, when wet, is very flimsy and easily tears, so great care must be exercised in the washing operations. There are single and double albumenized papers; the latter, however,

are the papers most liable to blister, and when purchased ready sensitized the albumen is apt to crack all over in the final drying. For my own part, I always find the single albumenized paper quite good enough for all purposes; but I would advise the photographer to always obtain his papers from a well-known and reliable firm.

*Sensitizing the Paper.*—I would also urge the amateur who dabbles much in the art, and has also a good laboratory or dark room, to sensitize his own paper, as much finer results can thereby be obtained, and it takes very little practice to enable anyone to sensitize the paper with speed and economy. The following is a good bath:—

*Sensitizing Bath.*

|                    |     |     |            |
|--------------------|-----|-----|------------|
| Silver nitrate ... | ... | ... | 50 grains. |
| Distilled water... | ... | ... | 1 ounce.   |

This is a really good bath, and will suit all papers alike. The solution is poured into a large shallow dish, and the paper floated upon it, albumenized surface downwards. The centre of the sheet should first touch the solution, each side being allowed to slowly fall in, so as to prevent air bubbles. The paper should remain on the solution about three minutes in summer, and in winter, or very cold weather, from four to five minutes. It is then lifted out, allowed to drain well, and then suspended by an American clothes-clip on a line to dry, and in a room free from dust and draughts. When nearly dry it is placed between sheets of clean blotting-paper and pressed, so that it may eventually dry smooth and flat. After five or six sheets have been sensitized in this way, the solution will want strengthening, as its specific gravity will be below par, and would not supply sufficient silver to any further sheets. This addition is made from a stock solution of good strength, say—

*Stock Silver Solution.*

|                    |     |     |            |
|--------------------|-----|-----|------------|
| Silver nitrate ... | ... | ... | 80 grains. |
| Water ...          | ... | ... | 1 ounce.   |

The silver solution should be frequently exposed to strong daylight to keep it clear and clean, and a few drops of a saturated solution of carbonate of soda may be added to precipitate the organic matter which is sure to appear after the bath has been used a little.

Paper prepared at home in this way will not keep longer than about twenty-four hours, and it is well for professionals to sensitize their paper over night, or if not then, it is the first operation in the morning. Home-sensitized paper may be kept for a few days if placed between sheets of blotting-paper which have been soaked in a strong solution of carbonate of soda and afterwards thoroughly dried. It has long been kept a secret by photographic dealers as to how they treat their ready sensitized papers to prevent them from discolouring and going bad. I may say that citric acid is the preservative used, and paper treated with this will keep good for several weeks. The paper is sensitized in the way just described, but is then plunged into a tank of water to wash out all the free nitrate of silver. After this it is floated face downwards on a bath of an aqueous solution of citric acid, and then dried. It is just as well, however, to buy this paper ready prepared; but in saying this, I would caution my readers against buying those papers which are guaranteed to keep for any great length of time. These papers have been treated with a very strong solution of acid to obtain this keeping quality, and are therefore very slow both in printing and toning, and brilliant prints will not be obtained. A paper that will keep in good condition for no longer period than a month will give almost as brilliant results as freshly sensitized paper. Matt surface paper is now coming much into vogue, and as I shall strongly advocate its use several times during these articles, I shall conclude this chapter with a description of its preparation.

The ordinary Rive's or Saxe paper is used, but as we purchase it for our present purpose without an albumenized surface, the paper must be sized and salted in order to prevent the sensitive salts of silver from sinking too deeply into its pores. Make up the following—

*Salting Solution.*

|                                  |            |
|----------------------------------|------------|
| Nelson's gelatine (ordinary) ... | 90 grains. |
| Chloride of ammonium ...         | 90 "       |
| Carbonate of soda (re-           |            |
| crystallised) ...                | 120 "      |
| Citric acid (crystals) ...       | 30 "       |
| Distilled water ..               | 10 ounces. |



The amount of gelatine greatly depends upon the paper used and the amount of size it already contains, and more can be added, if necessary; too much, however, will cause an objectionable gloss after finishing. This solution may either be brushed over the paper, or the paper may be floated upon it; for my own part, I prefer the latter method. Care must be taken not to wet the back, which should have a pencil mark upon it, so that we may then know that the reverse side is the prepared sensitized surface when commencing to print. After salting, the paper is hung up to dry, when it is ready for sensitizing at any time. For this a bath consisting of 60 grains silver nitrate to the ounce of water may be used, and this is much improved by adding to it some citric acid till all effervescence ceases and the reaction is slightly acid. A paper floated upon this in the ordinary way is quick in printing, and gives untinted prints of a rich colour. The paper is hung up to dry in the usual way, and if properly prepared should keep good for a couple of days. In the next chapter I will go through the various details of "Sun" printing, giving some useful hints by the way.

(To be continued.)

## A FOLDING CHAIR.

By JAS. SCOTT.



WAS conversing with a gentleman some time back, and during the conversation he made the remark, that "he considered there were too many folding chairs in the market." Asked by me for his reason for saying this, he said that when customers paid a visit to a furnishing establishment, and wished to purchase, among other things, a folding chair, they were often bewildered by so many patterns, and perhaps, instead of becoming buyers, they would leave, very likely saying that as they had seen so many alike each other, they would think it over and make a choice.

Gradually, however, I extracted from him the acknowledgment that there was plenty of room for something away from the lines that

are followed so closely by designers when "getting up" something new in folding chairs. The usual lines might be represented by a cross—the side rails crossing one another and being pivoted together. It is astonishing how seldom one comes across a folding chair that in any way represents the general style of solid furniture. The majority of folding chairs would look very incongruous in a dining-room. "But" someone may say "chairs of that description are scarcely wanted in dining-rooms." Perhaps they may not be of much use in every case; but I have been to family gatherings where a greater number of chairs than were already there would look crowded, but where a greater number were required for the time being; so that, if a few chairs had been stowed away in a folded condition, they would have taken up very little room, and would have been found of great utility upon certain occasions.

The chair illustrated in Fig. 1 is similar in appearance to a number of dining, library, and office chairs; but I believe there are none of such a pattern in the market, *to fold up*. Hence my reason for designing it for that purpose. Before proceeding further, I may say that if the same instructions are followed concerning the construction, small chairs for the dining room, etc., may be made by substituting a very low arm, or, instead, by having another rail on each side below the seat, and by making due allowance for the stuffing of the seat, which, of course, should not be attached in any way to the back feet.

Suitable dimensions for Fig. 1 are as follows: Seat—width on front 18 in., width at back 16 in., length  $16\frac{1}{2}$  in., back feet (measuring straight), 36 in.; length of arms (measuring straight), 30 in.; length of front legs, 18 in.; length of side rails, 20 in.; width of back, 18 in. on top, and  $15\frac{1}{2}$  at bottom. The seat and back might be upholstered, as represented, or made solid. I shall not say any more about this part, than that an inside framing must be sunk below the surface of both back and seat, on which to tack the webbing, etc.

The width and thickness of the various parts are really an optional matter, but the



following are as good as any. Front legs and turned rail, 2 in.; arms and back feet,  $1\frac{1}{2}$  in. wide, and  $\frac{7}{8}$  in. thick; seat, 1 in. thick; side rails,  $1\frac{1}{2}$  in. wide, and  $\frac{1}{2}$  in. thick; rail under

Fig. 3. In the rabbet thus formed the seat will be supported. The back corners of the seat must be cut as in Fig. 4, to allow it to fit round the back feet. On to the front of the seat are hinged the front legs, which have previously been joined together as in Figs. 1 and 2. The back and front legs are

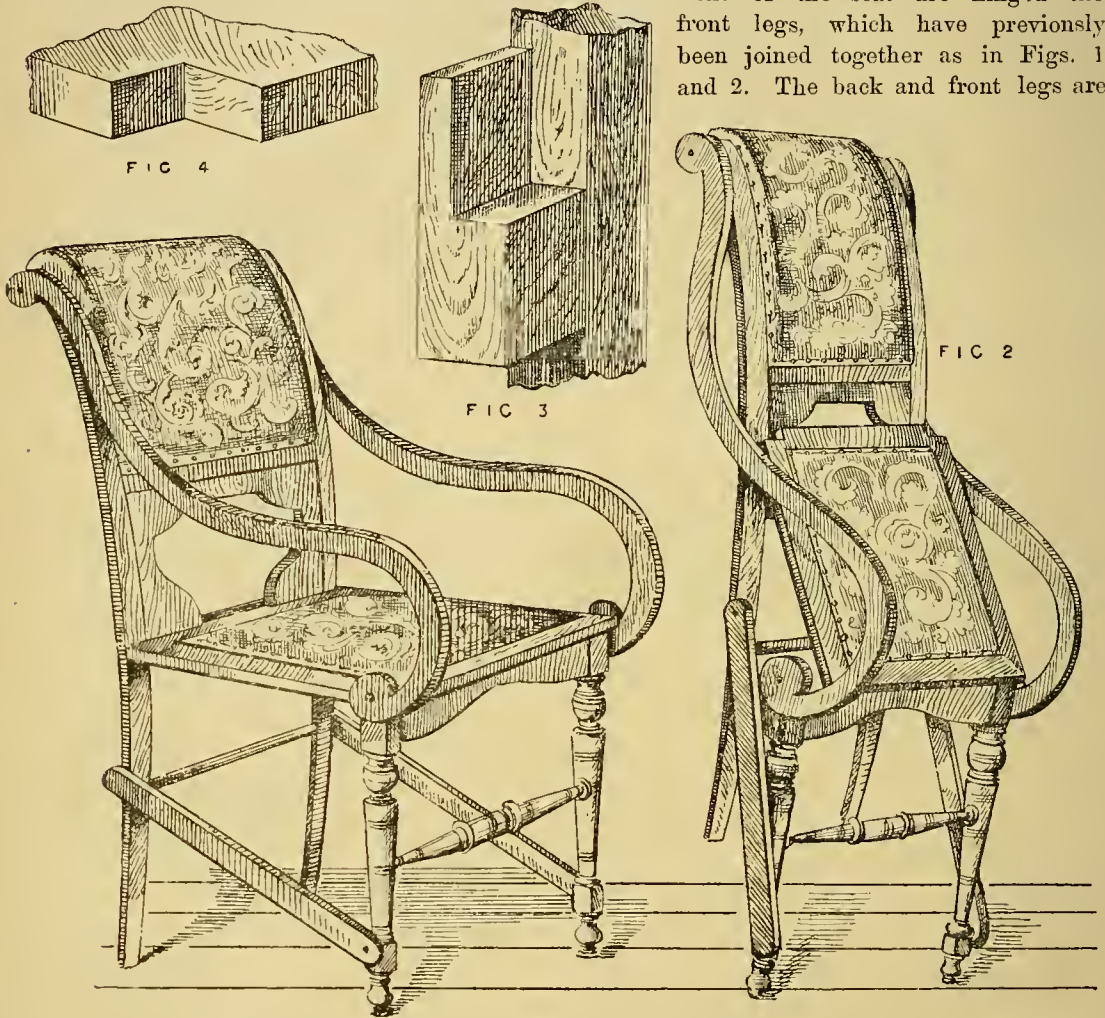


FIG. 1.—CHAIR OPEN. FIG. 2.—CHAIR FOLDED. FIG. 3.—SECTION OF RAIL AT BACK OF SEAT.  
FIG. 4.—CORNER OF SEAT AT BACK.

stuffing,  $1\frac{1}{4}$  in. wide, and  $\frac{7}{8}$  in. thick; rail at back of seat,  $2\frac{1}{2}$  in. wide, and  $\frac{3}{4}$  in. thick; and bottom rail between back feet,  $\frac{3}{4}$  in. thick.

The construction needs explanation. The two back feet are joined together by the rail under the stuffing and the stuffing frame, the middle rail and the bottom rail. The middle rail must be, in section, the same as shown in

prevented from slipping apart by the side rails, which are pivotted at one end to the back feet, and at the other to blocks in the front legs. The arms are fastened outside; the top end to the back feet, and the other end to either the seat or the top blocks of the front legs. To allow this chair to be moved about by only holding it by the back, it is necessary to have

a piece of wood similar to that I show in Figs. 1 and 2, hinged to the rail under the stuffing. This falls above the back of the seat, and is kept in position by the top part of Fig. 3. It matters not what width this piece may be, provided that it is hinged as above.

To close the chair, it is only necessary to push frontwards the shaped piece, and then push the seat upwards, letting the shaped piece fall back again; the back will then only want pushing upwards towards the front. To fold it up into a smaller compass, have a less sweep in the curves of the arms.

## THE WEIGHT OF FLY-WHEELS.

By ED. J. SMITH.

### I.—INERTIA—GRAVITY—THE LAW OF FALLING BODIES.



LITTLE information upon this subject may be useful to the large number of readers of AMATEUR WORK who are users of lathes, circular saws, and other machinery requiring the use of fly-wheels.

The first law of motion is that a body at rest will forever remain at rest unless acted upon by some external force, and a body in motion will for ever continue that motion, both at the same velocity and in the same direction, unless acted upon by some external force. The resistance which bodies exert to any change of motion or rest is called the force of inertia. Amongst other external forces, friction is always present with bodies in motion, and though it can be very much reduced it can never be totally eliminated; it is, therefore, constantly acting as a retarding agent. Were it not for this, perpetual motion, the beau-ideal of many an ingenious inventor, would be an accomplished fact; but as force or energy can never be created, and as all bodies in motion are continually subject to friction, it will at once be seen that perpetual motion must be an impossibility. Everyone must have witnessed, at some time or other, a horse yoked to a heavy load, and have noticed the superequine efforts to put that load in motion after a rest—how slowly the load moves at first, and how with each additional yard traversed the velocity increases

till when travelling at the normal pace the horse draws it with comparatively little effort. What made it such excessively hard work for the horse to start the load? It was the inertia of the load, which being at rest resisted the horse's efforts to put it in motion; and now, when once in motion, the horse has only to overcome the friction to keep it in motion at the same velocity. In like manner we know what violent exertions a horse has to make to bring his load to rest when he is pulled up suddenly; again he has to overcome the force of inertia, but in this case that of a body in motion. We may now consider the effect of a constant, *i.e.*, unvarying force on a body or mass, and for this purpose may conveniently trace the results of gravity, which for moderate distances from the earth's surface is practically constant. Now, since the force of gravitation determines the weight of any body, it follows that in this instance the force with which gravity attracts a body at rest towards the earth's surface equals the weight of that body, and for simplicity we will consider that we are dealing with a lead sphere of 1 lb. weight. This if let fall will be found to traverse 16 feet in the first second, starting from rest; at the end of the following second it will have reached 64 feet; at the end of the third second it will have reached 144 feet; at the end of the fourth second, 256 feet, and so on. Here it will be noted that a *constant force does not produce a constant rate of motion*, but a continually increasing velocity, the space covered being equal to 16 feet  $\times$  by the number of seconds squared, thus:—

$$16 \times 1^2 = 16 \times 1 = 16 \text{ feet traversed.}$$

$$16 \times 2^2 = 16 \times 4 = 64 \text{ ,, ,,}$$

$$16 \times 3^2 = 16 \times 9 = 144 \text{ ,, ,,}$$

$$16 \times 4^2 = 16 \times 16 = 256 \text{ ,, ,,}$$

Now it must be remembered that since gravity is a constant force, it is continually attracting a body downwards, whether that body be at rest, falling, or rising. This being understood, we may proceed to examine the various velocities (in feet per second) given by the above example. The weight starts from rest, and during the first second traverses 16 feet, and this it does entirely owing to the action of gravitation during that one second; if the weight is already in motion



its distance from the earth will be less by 16 feet for the first second, 64 feet for the second, and so on, than would have been the case had it continued in an unvarying, *i.e.*, constant, rate of motion instead of being subjected to the force of gravity; at the end of the second second it has fallen 64 feet, 16 of which it fell during the first second, therefore ( $64 - 16 = 48$ ) it fell 48 feet during the second second; but of this 48 feet gravity only pulled it down 16 feet, the remainder, *viz.*, 32 feet, was due to the velocity generated by its falling 16 feet in the *first* second; it therefore finished the first second, and commenced the second with a velocity of 32 feet. Again, at the end of the third second it has fallen 144 feet, which distance, minus the 64 feet due to two seconds fall = 80 feet, *i.e.*, the distance travelled in the third second, again deducting 16 feet, the result of constant gravitation, leaves 64 feet as the space covered owing to the velocity generated in the first two seconds; therefore the ball finished the second second and commenced the third second with a velocity of 64 feet; and if this investigation is pushed further, it will be found that the velocity at the end of each second = 32 feet multiplied by number of seconds; or, in other words, the velocity developed by gravity is directly proportioned to the time, whilst the space covered = 16 feet multiplied by the time in seconds squared. It being remembered that gravity is a constant *accelerating* force.

To facilitate comparison, the following table may be of use:—

| Number of seconds, | The weight commences each second with a velocity of — feet per second. | The weight at end of each second has a velocity of — feet per second. | Space in feet fallen in each second by a heavy body. | Total space fallen through at end of each second in feet. |
|--------------------|------------------------------------------------------------------------|-----------------------------------------------------------------------|------------------------------------------------------|-----------------------------------------------------------|
| 1                  | <i>Nil.</i>                                                            | 32                                                                    | 16                                                   | 16                                                        |
| 2                  | 32                                                                     | 64                                                                    | 48                                                   | 64                                                        |
| 3                  | 64                                                                     | 96                                                                    | 80                                                   | 144                                                       |
| 4                  | 96                                                                     | 128                                                                   | 112                                                  | 256                                                       |
| 5                  | 128                                                                    | 160                                                                   | 144                                                  | 400                                                       |
| 9                  | 160                                                                    | 288                                                                   | 272                                                  | 1,296                                                     |
| 16                 | 288                                                                    | 512                                                                   | 496                                                  | 4,096                                                     |
| 25                 | 512                                                                    | 800                                                                   | 764                                                  | 10,000                                                    |

## A WATER REGULATOR FOR AN INDUCTION COIL.

By *ELECTRON.*



**WATER REGULATOR** is used in connection with an induction coil, for reducing the force of the shock. It consists of a glass tube filled with water, and, having metallic caps at each end, the lower end is screwed on a base board, and connected to a binding screw; the upper end has a brass rod sliding through it, which can be set in any position; a binding screw is also fitted to the upper end; the lower end is connected by a wire to one of the terminals of the coil, and the upper end to one of the handles, the other handle being attached to the other terminal of the coil. It will be evident that when the end of the sliding rod is in contact with the metallic bottom of the tube, the full force of the current will pass, but if the rod be drawn up, the current will then have to pass through the water between the bottom of tube and lower end of the rod, and the water being an imperfect conductor of the current, a certain amount of resistance is offered to its passage, and the strength of the shock is reduced. The farther the rod is drawn from the bottom the greater the depth of water that intervenes, and the feebler the shock; the shock can thus be regulated to any extent.

Procure a strong glass tube  $\frac{3}{4}$  inch in diameter, and 6 or 8 inches long, also a piece of brass tube  $\frac{1}{8}$  inch larger than the glass tube; cut off a piece of the brass tube  $\frac{3}{4}$  inch long, mount it on a mandril, and turn the ends true; then cut out a piece of brass plate about 2 inches square (Fig. 1) and rivet in the centre of it a circular piece, a trifle smaller than the inside of the tube; tin the inside of one end of tube with a soldering bit  $\frac{1}{8}$  inch deep, and also the end, and tin round the circular piece on the plate; fit the two together, applying a little soldering fluid to the joints, heat a piece of iron red hot and put it at the back of the plate, and screw up tight in a vice till cold, when the tube will be fixed to the plate. After using soldering fluid the article should be well washed in hot water, to remove all traces of the acid. Fix



the glass tube in the brass tube and stem in two coils of twine, and fill the remainder in with red and white lead mixed to the consistency of putty, and stemmed in tight; leave till dry, then

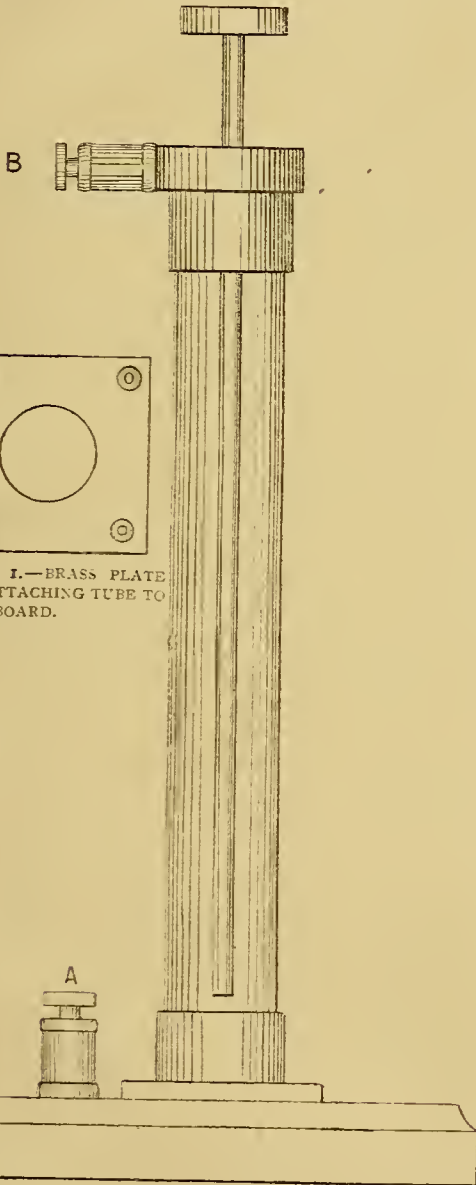


FIG. 1.—BRASS PLATE FOR ATTACHING TUBE TO BASE BOARD.

FIG. 2.—WATER REGULATOR, COMPLETE.

fix a similar tube on the top end, with a circular cap to screw on. This may be made from a gas union, with a circular plate soldered on the top. A binding screw should be screwed into the edge of the cap, as at B, Fig. 2, or upon

the top, if kept clear of the rod in the centre. A brass rod is fitted in the centre of the top rather longer than the full length of tube, with a wood knob on the top. A piece of tube should be fixed for the rod to slide through, so that it has a firmer bearing. Then fix the lower plate on a baseboard, with four screws through the holes shown in Fig. 1, and fix a binding-screw (A, Fig. 2) in the baseboard connected to the plate by a strip of brass. Fill the tube with water, and it is complete, as shown in Fig. 2.

## ROPE DECORATION.

OLD rope possesses many possibilities for decorative purposes. For the dividing line of rooms, and for accentuating architectural lines for the formation of panels, nothing could be more desirable. As ordinarily applied to picture frames it has usually been manilla rope of suitable size. But the effect of the gold or bronze is usually lost by not knowing how to treat the rope before gilding or bronzing. Before the rope has a coat of gold it should be filled with starch or glue. The rope then loses the appearance of a mass of fibres or a bundle of hair. If, after this treatment, it has a coat of bronze, or is gilded, it will have a massive appearance. Its decorative value may be enhanced in the highest degree. Treated in this way it becomes in effect a metallic rod. It may then be used in outlining panels, covering corners, filling angles, and in general taking the place of highly decorative and costly mouldings. Except in very large rooms, rope of one inch in diameter is as large as can be used with good results. It should always be three-stranded. Smoothly laid hemp rope has some advantage over manilla. It is usually smoother, and requires less filling.

For the decoration of panels and wall surfaces, good smooth, three-stranded cord one-fourth of an inch in diameter is an admirable material when gilded or even bronzed. It lends itself well to the tracing of the outlines of bold designs on natural wood panels. It may be used on any flat surface where it can be fastened with nails. The most suitable patterns for this kind of decoration are pure scrolls or the spiral

figures which are just now so fashionable with designers. Irish or Celtic interlacing work may be done in a wonderfully striking way with it. When applied to this form of design, two small cords laid side by side, and thus marking the edge of the ribbou, become most effective. In this case the gilding will be best done after the cords are in place. The cords are put in place with small, round-head, upholsterer's tacks. Another quite different but very striking effect can be produced by using woven or braided cord one-eighth or one-sixteenth of an inch in diameter. The nail-heads may be large enough to form a marked feature of the pattern. The designer will, of course, take this fact into consideration.

Doors, which are at times an eyesore, but which are necessary for practical reasons, can be made very ornamental by placing on them designs of rope work, and in this way made to harmonise with other decorations. By using painted instead of gilded cord the boldest designs are possible on perfectly plain painted surfaces which would otherwise be exceedingly unmanageable; but if not applied with skill and artistic judgment, the best designs will be utterly spoiled.

## NOTES ON NOVELTIES.

By THE EDITOR.

**M**ODEL ENGINES, CASTINGS, Etc.—Mr. H. Francis, engineer and model maker, 42 St. James Road, Forest Lane, Stratford, London, E., sends me his price list of model engines and castings. I have not seen specimens of his work, but he points out that his castings are “of modern design, heavy and well proportioned, and make splendid models of real engines (not toys).” He supplies sets of castings,  $\frac{1}{2}$  inch scale, for a model of a Midland Railway locomotive, for £1 12s. 6d.; or for a 1 inch scale model of a Great Northern engine, for £3. These models complete are sold at £10 and £30 respectively. He also offers the following complete sets of castings.

### *Model Launch Engine Castings, with Link Motion Reversing Gear.*

| No.    |                  |                    | Single. | s. d. | Double | Cylinders. | s. d. |
|--------|------------------|--------------------|---------|-------|--------|------------|-------|
|        |                  |                    |         |       |        |            |       |
| No. 1. | — $\frac{3}{4}$  | Bore 1 Stroke      | ...     | 3 0   | ...    | 0 6 6      |       |
| „ 2.   | —1               | „ $1\frac{1}{2}$ „ | ...     | 5 0   | ...    | 0 10 0     |       |
| „ 3.   | — $1\frac{1}{4}$ | „ $1\frac{1}{2}$ „ | ...     | 7 9   | ...    | 0 14 9     |       |
| „ 4.   | — $1\frac{1}{2}$ | „ $1\frac{1}{2}$ „ | ...     | 10 6  | ...    | 0 17 0     |       |
| „ 5.   | — $1\frac{3}{4}$ | „ $1\frac{3}{4}$ „ | ...     | 19 0  | ...    | 1 3 0      |       |

### *Horizontal Engines of Modern Design.*

| No.                  | 1.— $\frac{1}{2}$  | Bore 1 Stroke, Castings | ..  | £ | s. | d. |
|----------------------|--------------------|-------------------------|-----|---|----|----|
| „ 2.— $\frac{3}{4}$  | „ $1\frac{1}{2}$ „ | „ „ „                   | ... | 0 | 3  | 6  |
| „ 3.—1               | „ 2 „              | „ „ „                   | ... | 0 | 6  | 6  |
| „ 4.— $1\frac{1}{4}$ | „ $2\frac{1}{2}$ „ | „ „ „                   | ... | 0 | 9  | 0  |

I notice that his charges for turning any of the above are particularly moderate; but full particulars can be obtained by sending a stamp to Mr. Francis for his catalogue.

*The Weymersch Battery, for Domestic Lighting.*—On page 285 I mentioned, in reply to a correspondent, that I had just had my attention called to a system of electric lighting by means of primary batteries, of which great things were promised. The system referred to is that of The Weymersch Battery Syndicate, 2 Victoria Mansions, Westminster, S.W. I have had an opportunity of seeing an installation in actual work, and it had every appearance of being a complete success. Mr. Oswald Swete, electrician to the syndicate, has since supplied me with the following particulars:—

“The standard battery is made up in cell form, each cell containing 2 zincs of 108 square inches area each, and a carbon, the latter in a porous cell. Each porous cell is connected together at the bottom by means of an ebonite pipe and T pieces, the ebonite pipe terminating outside the battery case in a tap and gauge glass. Likewise also the outer cells containing the zincs are similarly connected, and terminate in a tap and gauge glass; therefore all the liquids are practically connected in parallel, but the elements are connected in series. The great advantage of this is, the extreme ease of filling from reservoirs, placed on a shelf or support a little higher than the battery; for if one porous cell be filled with depolarizer, all the others in the battery are automatically filled, so also the outer cells with acidulated water, from its own special reservoir.

The initial electromotive force is 13 volts from the six cells, the internal resistance 0.3 ohms, the maximum discharge is 15 amperes. The actual consumption of zinc over that of theory is only 10 per cent. The cost of depolarizer is one shilling per gallon (the recipe for which is a strict secret), and a six-cell battery takes  $1\frac{1}{2}$  gallons, which lasts with the maximum discharge of 15 amperes, 18 hours. The exerting solution is merely 1 of acid sulphuric and 39 of common water; each battery of six cells takes about 4 gallons of this. The actual cost of light is one halfpenny per 16 candles per hour. The battery measures 2'—8" x 10" x 1'—2"; weighs when charged about  $1\frac{1}{2}$  cwt., and costs £7 complete.

Instead of lifting out zincs and carbons, etc., all one has to do when the battery is at rest is to run off the acid water only, which can be done in a moment by merely turning the proper tap; leaving the depolariser in the porous cells.

The Britannia Co., Colchester, have sent me drawings and descriptions of a dowelling attachment for their new circular saw, as well as other handy apparatus for amateurs, but space compels me to postpone a notice of these until next month.

## AMATEURS IN COUNCIL.

For "Instructions to Contributors and Correspondents," see p. 46 of this Vol., or Part 13 (New Series), p. 46.

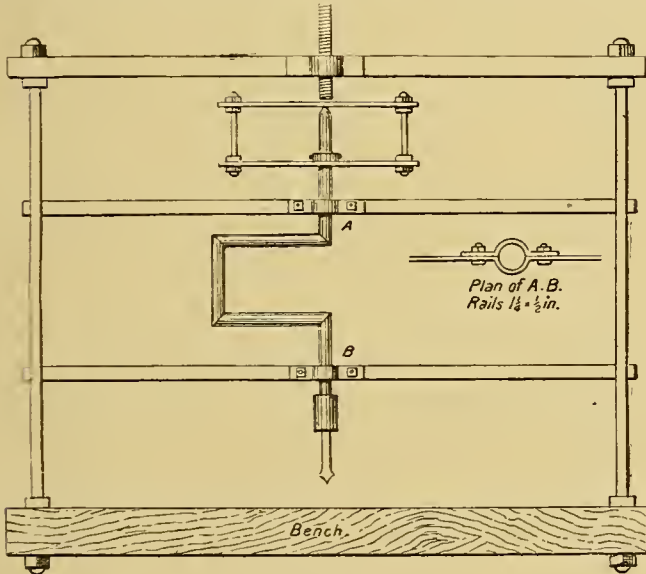
## A New Drill.

JOHN ROBERTS writes:—"I enclose sketch of a new drill; at least I think it will be new to all the readers of AMATEUR WORK, as it is one that I designed for my own use some years ago. I find that it is much easier to work with, when holes are required  $\frac{3}{4}$  inch and upward, than those with

he says that any boat moored as described by me 'would swamp herself in a short time with only an ordinary breeze.' My overlooking of this serious defect in the device was entirely owing to the fact that in thinking it out I was concentrating my attention on the preservation of the boat from the perils to which mischievous men and boys might subject it, and forgetting entirely the perils of the weather. Had the title I originally gave to the article, clumsy though it was—"Anti-Interference Moorings for Boats"—been retained, it would have been plain to all at the outset that that was my only

second column of page 50, minus the padlock and buoy. As to the padlock being no defence against a boat thief, I do not deny that. The only effectual way that I know of to protect a boat from a boat thief who will stick at nothing, is to lock it up in a burglar proof safe! But boat thieves are by no means common in this country, and I was not reckoning with them at all. All I wanted to do was to protect the boat against the 'small boys,' to whom 'Excelsior' alludes (and small boys do not generally carry Star back-saws among the very miscellaneous contents of their pockets), and also against the attacks of some who have reached 'man's estate,' but who still retain a boyish liking for mischief. Such people do not wish to steal one's boat; but if without putting themselves to much trouble, they can lay hands on a boat, they will make use of it to amuse themselves, regardless of what the boat may suffer in the process, and will go off and leave it unmoored and liable to float into the way of, and be run down by the next passing steamer, or to drift away never to be heard of again. I think as a protection against these the padlock is very much superior to the sinking of the shore weight a few inches below low-water mark, which is the method 'Excelsior' suggests. Then with regard to the buoy referred to in the paragraph on page 50, with which I am dealing, it is of course rather an unnecessary addition to the device—at least such a buoy as is shown in the engraving; but a small float attached to the rope to which the painter is made fast, might not be quite useless, as in the event of the moorings being interfered with while one was out rowing or sailing, and the rope pulled out towards the anchor or outer weight, the float would tend to prevent the rope, while being pulled ashore, getting entangled with anything at the bottom.

"Excelsior" twits me with the fact that the whole business must have been invented hundreds of years ago. I have learned since the article was written that I had been anticipated in the idea of using an endless chain for such a purpose; but at the same time I must assure the readers of AMATEUR WORK that I really discovered the thing for myself, and only learned afterwards that it was nothing new. Even sup



SKETCH OF DRILL.

gearing, as there is a direct action. The sketch explains itself, and requires no explanation here. It can be made light or heavy according to the work required, and the dimensions according to the room at disposal. I have easily bored wagon wheels  $1\frac{1}{2}$  in. diameter."

## Safe and Secure Moorings for Boats.

W. P. M. BLACK writes:—"I may perhaps be permitted, in justice to myself, to make a few comments on 'Excelsior's' criticisms on page 193 of the present volume of AMATEUR WORK, of the arrangements described by me in Parts 2 and 4 of Volume I. of the New Series.

"In the first place, I cannot but admit that (with the exception mentioned later on) 'Excelsior' is right when

aim; but the general tenour of the article shows the aim I had, and how I kept it too exclusively in view. I had not the advantage of a practical test of the apparatus to correct its faults, though I must confess that I would not have needed that for the defect referred to, had I looked at it from every point of view. I was rendered all the more liable to fall into such an error, from the fact that in all my thinking I had the still waters of a certain canal in my mind's eye, and that, though I claim to know a good deal about boats, I never owned one, and hence never had to see to a boat's housing.

"The mooring arrangement that 'Excelsior' describes is simply the form of the device I suggest at the top of the



posing, however, I had known about the endless chain, the idea of the padlocking together of a link of each side of a *pretty taut* endless chain, simple though it was, entirely changed the character of the device, and converted it from being a comparatively useless thing, dependent for its success upon lack of observation on the part of those against whom it was intended to guard the boat, into being a safeguard not certainly against hack-saw armed boat thieves, if such exist, but undoubtedly against mischievous men and boys, whom some of us know to our cost swarm in some localities.

"Further, I would like to refer to that part of 'Excelsior's' article where he tells his readers, 'to the end of this rope the boat is fastened, *at the bow*, not at the side as shown by your correspondent.' I would be utterly unworthy to write on anything connected with the water if I had made such an outrageous mistake as 'Excelsior' supposes me guilty of. At the same time, he is not to blame for thinking me guilty; for the engraving does undoubtedly show the boat fastened by the side. Well, what I have to say in reply is that it was the engraver who not only represented the boat as moored by the side, but also as having its bow pointing shoreward—certainly a very different arrangement from what I attempted to show by my sketch; but as I do not pretend to know anything about drawing, the engraver may have misunderstood my sketch. My sketch was intended to show the boat moored by the bow, and heading seawards.

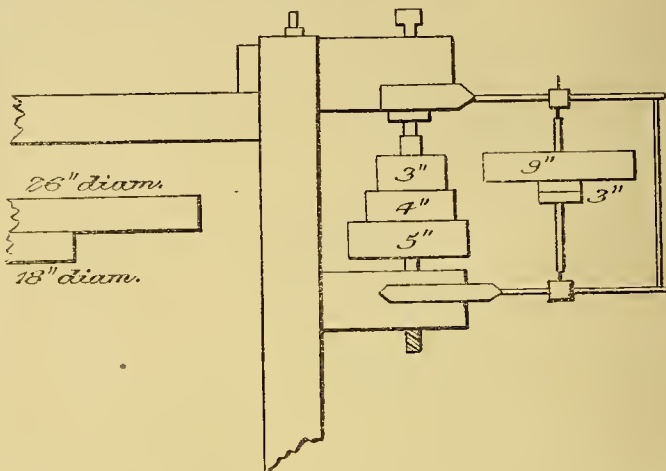
"The form of the device described by me on pages 188 and 189 is not, I think, open to the only valid criticism 'Excelsior' brings against my plan; for as it allows of the chain being left as loose as one likes, the chain, if long enough, will hang down vertically from the buoy, and so will be cleared by the boat into whatsoever position she may swing with wind or tide.

"I would just like, in concluding, to say that I owe 'Excelsior' anything but a grudge for what nevertheless I must term his rather wholesale onslaught. It has served to confirm me in the belief that what was really original in the device will serve its purpose. For pointing out to the readers of AMATEUR WORK the faults in it, as described by

me, I am very grateful to him; for although I had discovered them long ago, I did not see my way to do what 'Excelsior' has done for me."

#### Speed Gearing for Lathe.

C. J. WOLFE writes:—"I have recently made a gearing, of which I give a sketch, for increasing or decreasing speed. The mandril will make thirty



revolutions to one of the crank, or by reversing the countershaft on its centres, it will make two to one, which is very convenient. Perhaps Rev. Dwyer or Mr. Smith will favour us with an opinion."

#### Offers of Lathe Work.

"ELECTRON" replies to "R. S.," page 285:—"If you will write me through the Editor, stating your requirements, I will try to help you."

E. MARTIN, 6, Yoxford Villa, Beccles, Suffolk, writes:—"Having plenty of spare time, I shall have much pleasure in assisting 'R. S.,' who seems to be in a difficulty about getting articles turned. As I am an amateur, I should only charge a small sum beyond what the castings, wear and tear of tools, etc., would cost. I shall be much obliged if you will give him my address, and make it public. I am always glad to do anything of the sort for 'Amateurs in Council.' I take a great interest in AMATEUR WORK, to which I have subscribed from the first."

FREDERICK DIPPIE, 18, Hampshire Street, Cheetham, Manchester writes:—"In reply to 'R. S.,' I beg to say I do all sorts of small work at home on my

lathe. I am a mechanical engineer, and thoroughly understand my work. Am reasonable in charging."

J. B. writes:—"If you write to Britannia Company, Colchester, they can recommend turners who will do the work. Among their numerous customers are many who would do work at a fair price."

A. J. T. OGREN, 2, Foss Bridge, York writes:—"Adverting to the inquiry of 'J.D.' (Tiverton), made in our paper under the head of 'Information Sought.' I beg to state that I should be very glad to give the assistance required, and to answer any questions on the subject."

S. STEVENS (17, Huntingdon Buildings, Shoreditch, E.) writes:—"The complaint of 'R. S.' as to the difficulty of getting small jobs of turning done is very true. Manufacturers, as a rule, do not care for them, as they do not pay unless they charge a long price, and get put aside and forgotten. I have had the same trouble myself with other kinds of work. I have taken in AMATEUR WORK from the first part, and it has struck me that readers must often have to abandon the idea of making some of the articles described because they cannot do some part themselves for want of tools, and do not know anyone who would do it for them. Noting your remarks at the end of the letter from 'R. S.,' I thought I would offer to help. I have two lathes with slide rests, and plenty of tools, and I can undertake to do any kind of turning and fitting in brass,

iron, steel, copper, or gun metal in a short time at a reasonable charge, no matter how small a job, in London or, by the aid of the Parcels Post, in the country. If 'R. S.' or any of the readers of *AMATEUR WORK* like to give me a trial, I should feel obliged if they communicate at first by post, as I am only at home in the evening."

#### Chinese Soldering.

H. J. W. writes:—"The sample metal enclosed is taken from a tea box, as it is made in China. You will notice very fine soldering on seams. I have tried time and again to solder some of this metal, but could not make it with any kind of flux. If you or some brother amateur can enlighten me on the much maligned "Heathen Chinese's" handicraft, I will be much obliged."

I passed your enquiry on to one of my staff who is an authority on such matters, and he replies:—"On receiving the sample of metal sent, I at once took it into my workshop, and taking up one of my ordinary soldering irons, I heated it to a moderate degree in my gas fire. I scraped the surface of the lead foil, applied a very small dust of resin, and then with my ordinary Tinman's solder, succeeded in uniting the two pieces of metal, making a lap joint, same as sample, which I send for Editor's inspection. My joint, though not looking quite so smooth as the sample, was quite as strong, and had I made special preparation, such as making some extra fine solder, using a lighter iron, etc., I do not think I should have had any difficulty in equalling the specimen sent. I do not see anything in the 'Heathen Chinese's' handiwork that cannot be done by anyone used to soldering, given as they are clean new lead foil, and a solder fusing at a low temperature. Try a solder of two parts tin, one part bismuth, and one part lead, and use a light clean iron.—L. L."

#### Portable Fountain.

"FOND OF FOUNTAINS."—A portable fountain worked by a hot air engine and small force pump, has not yet been described in *AMATEUR WORK*, but at your desire, and as the subject will no doubt interest many readers, I have requested one of my staff to write a paper on the subject, so that you will eventually get what you want.

#### Connecting Electric Bell to ordinary Bell Pull.

F. S. M. writes:—"I am very much obliged to Mr. Edwinsou for his answer to my query regarding the electric contact for an ordinary door bell. Before the answer came to hand, however, I had studied the matter out, and had my bell fixed. My method was somewhat different from his, and I think is better and simpler for an attachment to a wire that runs perpendicular instead of horizontal, although it is equally good for either

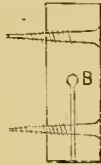


FIG 2

style. The wire does not need to be cut or changed in any way. The diagram will illustrate it. A is a strip of thin wood six inches long and one inch wide. At each end is attached two blocks of wood or vulcanite  $\frac{3}{8}$  of an inch square, and an inch long. If the bell wire is not cut, these blocks will need to be made as in Fig. 2, having a saw-cut in as for the hole through which the wire passed, to allow the wire to be pushed into place. The holes should be made large enough to allow the wire to run freely in them.

The blocks are fastened to the back by a couple of screws, one screw drawing the cut place together. C is a strip of spring sheet brass bent as indicated, and fastened to the back by screws. It should be bent out so as to almost touch the wire, but not quite. Perhaps it would be safer to countersink a screw into the lower end and fastened to the back, making the hole big enough to allow the spring to play backwards and forwards. The head of the screw would prevent the spring from bounding back against the wire. D is a small piece of brass rod with a hole through the centre, and screwed in place on the wire by a set

screw. It will have to be cut through the side, as the vulcanite blocks were, unless the wire is cut. One wire is fastened to this, and the other to the spring C. When the bell is pulled D comes in contact with C, and the bell rings as long as it is held there. This arrangement is very simple, and is made in a few moments. Of course it is unnecessary to say that it is screwed to the wall past which the wire runs."

#### Barrel Organ.

WOULD-BE ORGAN GRINDER (page 240).—The bellows have two feeders, generally at the end; these are worked by a cranked axle which also turns the barrel, by means of a worm wheel; the end of the axle is brought through the case, and has a handle fixed on, which in your case will be replaced by a pulley worked with a belt from the treadle wheel. The wind chest and pallets project slightly in front of the sound board, and the pallets are pressed down by a long wire in the end of the stickers; the top ends of stickers are fixed into a set of back-falls, the opposite ends of which are raised by the pegs on the barrel. The barrel is divided into as many spaces as there are bars in the tune, and the notes or pegs are put under the proper back-fall; they are formed of brass wire staples. The barrel is moved endways to clear one set of pegs. In putting a second tune on, the tunes are generally in one key, to save putting in pipes for all the semitones.—ELECTRON.

#### Substitute for Paint Brush.

W. ACKLAND writes, in reply to "T. S. M."—"Get a small piece of round wood, and sharpen one end a little, then cut a few bristles from an old house-broom, according to the size of brush you want (from the centre is best), place the bristles round the sharpened end of wood, then get a piece of twine, fasten one end to a holdfast in wall or something strong, fasten the other end round bristles and roll it from you, pulling the twine taut at the same time; when rolled up sufficiently, tie it securely, and then you will have a rough paint brush. I have made and used a good many in this way, being an amateur in wood-work and painting." [The writer encloses a specimen brush, which I have used, and find that it answers its purpose admirably.—Ed.]



**Glass Blowing.**

HENRY (page 240).—You will require a Bunsen burner, and a pair of bellows to work with the foot. If you refer to Vol. II. of *AMATEUR WORK*, page 509, you will see a drawing and description of bellows; if you have no Bunsen burner, the blowpipe there described will do, if fixed vertically on a bench. The pipe from which the gas supply is taken, should be  $\frac{1}{2}$  inch, an ordinary burner is too small; the flame should be 7 or 8 inches long when blowing; put the two ends of the glass to be joined into the flame, and keep turning them round till fused, when they can be joined. If the join is not smooth, put them in the flame again, and turn till smooth. I have cut bottles by filing a notch round them, then applying a hot poker, and dipping them to the level of the mark in cold water; after two or three dips it will come in two, and the edge can be ground smooth. A method of cutting glass bottles is given in the present volume of *AMATEUR WORK*, page 201, by "Excelsior."—ELECTRON.

**Musical Glasses.**

MECHANIC (page 240).—The glasses are tuned by pouring water into them till of the proper tone. Thin glasses are best; they should be fixed into a board with holes in at the bottom, to prevent them moving, the finger is wetted and run around the rim to produce the tone. Some recommend vinegar instead of water to wet the finger, but I have not tried it. I have found wine-glasses sound best.—ELECTRON.

**Tightening Lathe Band.**

OLD IRON (page 238).—Your method is just as good as the one described, and as you say, does not interfere with the walls or ceiling. I think you will find it useful in case of breaking the band. A friend of mine broke the hook of his band, and the piece of band screwed into the hook, and on fixing a new hook the band is too short, whereas if fitted in this way, a little shortening of the band does not affect it.—ELECTRON.

**Shooting Board.**

CHARLES BURNETT.—"You cannot do better than write to Melhuish, 85, Fetter Lane, London, E.C., stating exactly what you require. They supply every kind of tool that an amateur can possibly want."

**American Organ Building.**

B. W. NUNN writes:—"The near situation ( $1\frac{1}{8}$  inch at one end) of cells to the front edge of reed-board, scarcely allows space for front swell-shutter, which, if placed in position, certainly could not swing without colliding with mutes. How is this difficulty to be overcome?"

The proper distance of the bass end of front cells from the edge of reed-board should be  $1\frac{1}{8}$  inch. You must therefore have got hold of a short board, or perhaps you have trimmed it off too much in fitting on to the frame. If there really is not sufficient room for the front shutter to act (remember the shutter only opens a short distance), your best course will be to reduce the width of the front of swell cover a little, and alter the action of the swell by hingeing with a strip of webbing from the top, instead of using the swivel centre. There will then be room for it to swing outwards. Of course the back swivel shutter must be altered in like manner.—T. L. W.

**Where to Buy Magnets for Telephone.**

W. H. O. P.—If you intend to magnetise the steel bars yourself, you can get the rods from most dealers in steel. Dealers in watchmakers' sundries generally keep in stock steel rods from the smallest thickness to those of a considerable diameter. In this way you may get the very finest soft steel. There are many dealers in iron and steel in a large town, who, if not possessed of the article themselves, will readily direct you to some place where you can always get a supply of what suits you. A square rod will do if the end is turned down to fit the hole in the bobbin. If you require magnets ready magnetised you may possibly find a difficulty in purchasing them, as the telephone is a patent, and the owners of the patent are very naturally jealous of their rights, and consequently firms dealing in articles of this kind are cautious, as they do not wish to be involved in disputes, whether rightly or wrongly. If you cannot buy the magnets ready magnetised you can make them, and then get them magnetised by some firm of electricians. There is no patent in a simple bar magnet, but it is in its application or combination that legal difficulties present themselves.—J. H. M.

**Cleaning Files.**

A. CHATTERTON wants to know how to clean files clogged with grease and wood.

Dip them into hot water for a few minutes, and then brush them well with card wire.—J. H.

**Pneumatic Action.**

W. C. (*Greenock*).—I have a reply for you, accompanied by an explanatory diagram, that will assist you out of your difficulty. It is not, however, of sufficient general interest to produce in these columns; but if you will send me a stamped addressed envelope, and refer to this reply, it shall be sent on to you by post.

**INFORMATION SUPPLIED.****Spring Motor.**

II. SMITH replies to W. C.:—"If he will communicate his desires and requirements to W. Tunbridge, 7, *Jervoise Street, West Bromwich*, he would supply him with any kind of springs (steel) he may require, for cash, and he will warrant them best goods." [The *Britannia Co., Colchester*, also supply springs for this purpose.—Ed.]

**INFORMATION SOUGHT.****Where to Buy Chime Gongs,**

V. DENT writes:—"At the Crystal Palace I heard a bell accompaniment to a solo on grand organ. I can adapt a dozen or two single stroke electric bell fittings, if only some reader can assist me in procuring  $1\frac{1}{2}$  or 2 octaves (diatonic) of chime gongs. The connections and fittings I can do myself. A second-hand set would do. *Gongs* only."

**Glass Working.**

HENRY writes:—"Wanted, a few instructions in glass cutting and blowing, such as cutting down broken decanters, tumblers, vases, etc., and blowing the feet on wine-glasses, etc. A few instructions as to tools necessary, etc., will oblige."

**LETTERS RECEIVED UP TO MAY 9.**

A. WESTON; F. H. IRESON; A. J. B. U. (*Ceylon*); F. W. P. (*Manchester*); J. H. LOWE (*Reading*); B. A. Y.; V. DENT; A. CHATTERTON; H. A.; E. F. MOORE; T. H. HARRISON; DAYNOOK; CHARLEY FAUST; G. EDWINSON; F. C. I. A.; NIGHTLIGHT; E. WILLOUGHBY.





## A BLOWER FOR SCREENING GRAIN, By F. C. H.

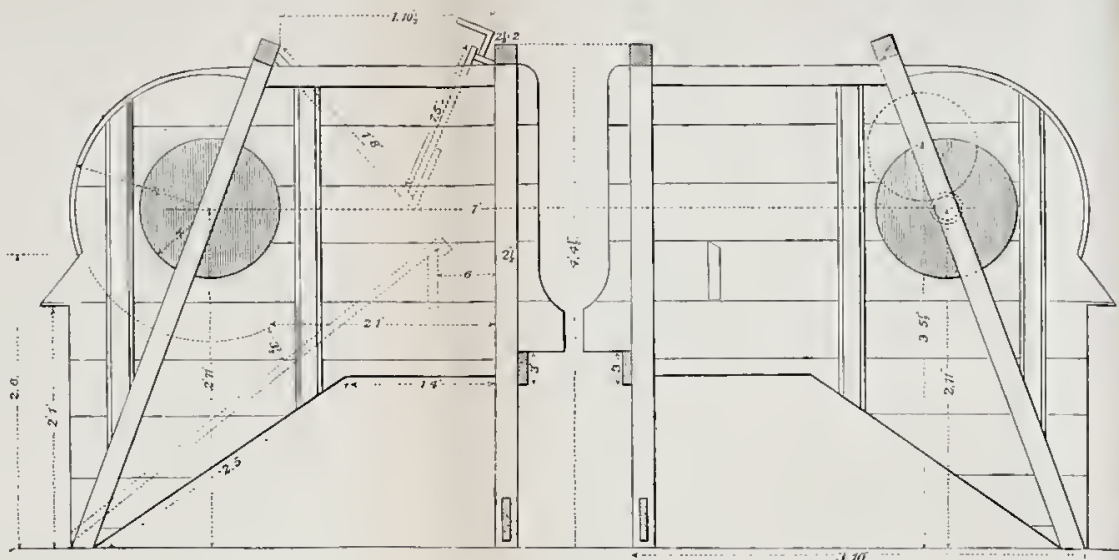


FIG. 1. SIDE ELEVATION.

FIG. 2. SIDE ELEVATION.

Scale, 1 Inch = 1 Foot.

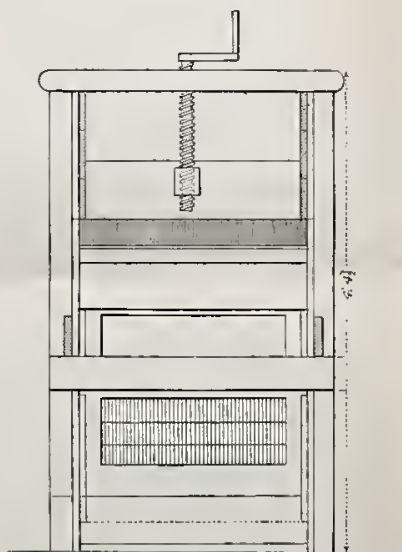


Fig. 3. Back.

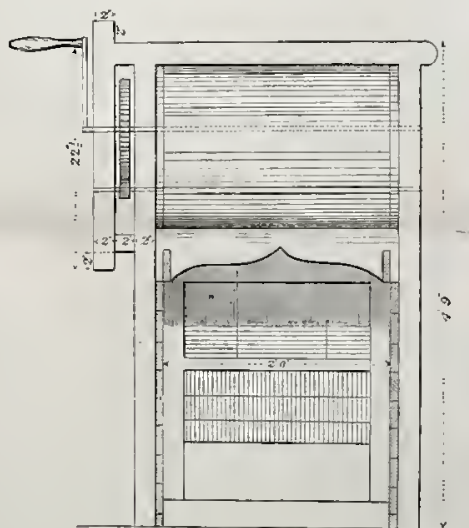


FIG. 4. FRONT.

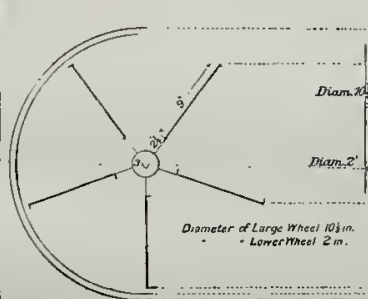


FIG. 5. SECTION OF FAN.

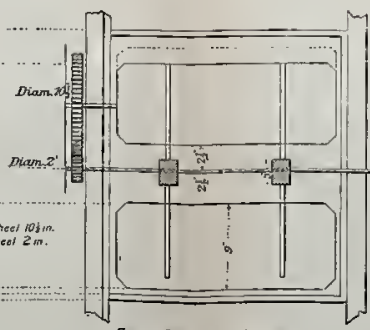


FIG. 6. SECTION & ELEVATION  
OF FAN.

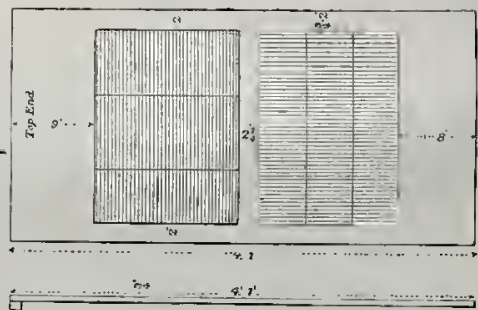


FIG. 7. SIEVE.





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## A CIGARETTE MACHINE.

By *ELECTRON*.

**M**OST smokers prefer some particular brand of tobacco, and as they cannot always obtain it in the form of cigarettes, they purchase the tobacco and papers separately, and roll them by hand; but unless the maker is very expert, the cigarettes made in this manner are not always satisfactory. By the aid of the apparatus now to be described, anyone with a little practice can soon make good cigarettes.

that when not in use the three pieces can be folded together.

Make a rod about 5 inches long, and round one end till it will fit the hole in the tube, Fig. 1. The paper must be cut to the length of tube and folded on this rod, and the edges gummed. When dry, the small end of paper is slightly twisted and the stemmer inserted, and the paper pushed into the tube. Withdraw the stemmer, and put the small end of Fig. 2 into the end of tube, the end of the paper being outside, which will hold it while being filled. Put the tobacco into the funnel and press it down into the paper by the stemmer till filled, then take out the

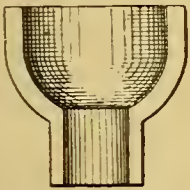


FIG. 2.—SECTION OF  
END FOR FILLING  
TUBE.



FIG. 3.—STEMMER.

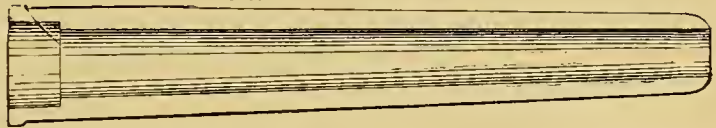


FIG. 1.—SECTION OF TUBE.

Procure a piece of dry, well-seasoned hard wood, that is not likely to split, about  $3\frac{3}{4}$  inches long; bore through the centre of it a conical hole  $\frac{3}{8}$  inch in diameter at the top end, and  $\frac{1}{4}$  inch at the lower end; enlarge the hole at the top end for  $\frac{1}{4}$  inch to a little under  $\frac{1}{2}$  inch in diameter. The hole may be bored through  $\frac{1}{4}$  inch with a shell bit, and enlarged at the top end, and smoothed with a round, tapering file. The outside may be turned, or rounded by hand, and smoothed with rasp and glass paper. Fig. 1 is a section of the tube. Next prepare a funnel-shaped piece, similar to Fig. 2, about 1 inch long, bore a  $\frac{3}{8}$ -inch hole through it, and enlarge it to  $\frac{3}{4}$  inch, as shown, at one end. The outside of the smaller end must be made a good fit into the enlarged end of Fig. 1, the remainder being turned or cut as shown.

Make a stemmer 4 inches long, and  $\frac{1}{4}$  inch diameter, of hard wood, and fit on the end a piece of wood 1 inch diameter, of the form shown in Fig. 3. The rebate on the edge should be made to fit into the wide end of Fig. 2, so

funnel, and push the cigarette out from the small end by the stemmer. A little practice will soon tell the amount of force to be used in stemming, as, if pushed too tight, it may tear the paper. The paper must be folded at the large end when filled.

A thick paper tube will be required for a mouth-piece. To make this, fold some cartridge paper three or four times round a wooden rod  $\frac{1}{4}$  inch diameter, gumming the paper as it is folded, and wrap a piece of tape round the paper till dry. When dry, cut into lengths 1 inch long, gum round the inside of one end, and insert the small end of the cigarette. When dry it is ready for use. A piece of box wood will be the best material for making the tube and funnel.

**TEMPERING DRILLS.**—A simple and effective method of hardening and tempering small drills  $\frac{1}{16}$  inch in diameter and under, consists in heating the drill to a cherry red, and immediately plunging it into a ball of beeswax.

## GALVANIC BATTERIES.

By ALLAN TRAYNOR.

VI.—THE GROVE CELL—THE BUNSEN CELL—SELECTING AND PREPARING THE CARBONS—THE CONTAINING VESSELS—THE MANAGEMENT OF THE BUNSEN—THE FULLER CELL—THE GRANULE CARBON CELL—A CHEAP BATTERY FOR ELECTRIC LIGHTING.

*The Grove Cell.*—The elements of Grove's cell are zinc for the positive, and platinum foil for the negative, element. Fig. 5 shows one of the methods of arrangement. The outer cell A is of glass or earthenware, charged with dilute sulphuric acid, in the proportion of 1 of acid to 8 of water. A cylinder of amalgamated zinc is placed in this vessel. Within the zinc is a porous cell charged with the strongest nitric acid, in which the platinum foil is placed. To increase the surface of the negative element the platinum is bent in the shape of the letter S. When the cell is in action unpleasant fumes are given off by the nitric acid. As the fumes are injurious to health when breathed for any length of time, the platinum is furnished with a wooden lid which closes the porous cell. It is better, however, to keep the cell out of doors when in action, leading stout copper wires from it to whatever work may be going on.

Another arrangement of this cell is shown at Fig. 16, where the containing vessel is a square one, and the porous cell (F) flat with a lip at each corner for pouring out the liquid. The zinc plate in this arrangement is made of a long strip bent in the form of the letter U. The zinc is thus brought opposite each side of the platinum. This arrangement, however, gives less power than if the zinc were cylindrical. The main objection to the Grove cell is its cost. The platinum foil costs about 30s. an ounce, but this quantity is not necessarily expended in one cell. How far it will go really depends on its thickness; and here it may be noted that the foil should in no case be too thin.

The internal resistance of the Grove cell is very small, and hence a powerful battery may be put into little space. Twenty cells give a splendid electric light, while with five rows of 10 cells each the results are magnificent. The Grove is admirably suited when a powerful

current is required, as in the working of large induction coils. Its E.M.F. is 1.95 volt, and the time during which it will yield this without recharging is about four hours.

*The Bunsen Cell.*—The Buuseu cell differs from the Grove by the employment of a plate or block of carbon for the negative element, instead of platinum. The liquids are the same: strongest nitric acid in the porous cell with the carbon, and in the outer jar with the zinc cylinder 1 part sulphuric acid to 10 or 12 of water. On account of the absence of the expensive platinum, the Bunsen is to be preferred to Grove's cell. Fig. 17 shows a Bunsen cell set up, the zinc and carbon elements being shown at z, c, respectively, the latter with clamp for connection.

The carbon may be a square block or a plate. The former requires a clamp for connection; the latter is usually purchased with binding screw attached. Sometimes the hard carbon obtained from gasworks is employed, and only cut down so far as will allow it to enter the porous jar. Electrically speaking, this carbon is much better than the artificial block or plate, its only drawback being its hardness. When retort carbon is employed in a battery, *i.e.*, in two or more cells, all the pieces should be as nearly as possible of the same area; and whether retort or artificial, it should be hard and of a clear grey colour. When carbon is black and soft, the resistance of the circuit is increased, and the current is thereby reduced. Before being placed in cells, the tops of blocks and irregularly shaped pieces should be soaked first of all in melted paraffin wax. This is to prevent the acid from creeping up and corroding the connection.

Perhaps the most effective method of preventing the creeping up of acid is to give the top of the carbon a heading of lead. To do this, the end of the carbon is first made perfectly dry, and a score or two marked round with a bradawl, about an inch from the end. A square mould, made of putty, is filled with melting lead, and before the lead sets the carbon end is dipped into it, and kept there till the lead becomes solid. A binding screw may be soldered to the lead top while it is still hot. The lead then receives a coat or two of Brunswick black.



Another method of making effective connection with carbon is to deposit copper upon the end, and then solder a binding screw to the copper. The simplest method of doing this is to charge a Daniell cell, as already described. Make sure that all grease is removed from the carbon, and connect it to the zinc pole of the cell. Dip the end of the carbon on which copper is to be deposited into the sulphate of copper solution, and keep it there till a fairly thick coating of copper is deposited upon it. The carbon is now removed and soaked in water till all sulphate of copper has been dissolved out of it. Dry the copper deposit thoroughly, and solder a binding screw to it.

With regard to the zinc, it must be borne in mind that perfect amalgamation is necessary. Should any black patches appear through time, amalgamation should be repeated.

Containing vessels may be salt jars, which can be purchased very cheaply. Porous jars should be at least 5 in. high, and  $2\frac{1}{2}$  in. diameter; the zinc cylinders should be  $4\frac{1}{2}$  in. high, 3 in. diameter, and  $\frac{1}{8}$  in. thick. The carbon blocks should be  $5\frac{1}{2}$  in. high, by  $1\frac{1}{2}$  in. square. These are the smallest sizes for the best work, but of course larger sizes may be used.

*The Management of the Bunsen.*—The Bunsen cell is one of the best for the production of a constant powerful current, lasting for 3 or 4 hours. During work it sends off disagreeable fumes, and should be kept out of doors. Thick, well insulated wires should be led from it to whatever work it may be doing.

Should a battery be set up for electric lighting, or any other work requiring the most powerful current possible, the charge of sulphuric acid should be 1 part acid to 5 or 6 water, and the liquid in porous and outer jars should be of equal height. When charging, care should be taken that no nitric acid is spilled in the outer jar among the zinc. When this happens it causes very violent action.

Perhaps the best way to charge a Bunsen battery is to proceed as follows:—Place the zincs in the empty outer jars, then the porous jars, with their carbons only, inside the zinc cylinders. Fill both cells first with water—the porous cells to within an inch of the top, and the outer cells

to the same height as the water in the porous cells. Now pour the water from each separately into a graduated measure, and note the point on the scale. This will give an idea of how much exciting liquid outer and porous cells require, and is the only cure for spilling. The battery should never be charged till within a short time of its being required.

When an intense current is wanted, the cells are connected in series, and all connections should be carefully examined to see that they are right. When first set up, the current may be weak. As the acid works through the porous cells, however, the current will increase in force, and the time it takes to reach full force will depend on whether hard or soft porous pots are used. The sulphuric acid is useless after four hours' work, and may be thrown away. The nitric acid turns red, but may be used again; its second period of service turning it green. It may be used still a third time, when it turns clear again; it is then exhausted, and a fresh supply is necessary.

When the battery has ceased working, the zincs should never, on any account, be left in the cells. They should be removed and placed among water, that all traces of acid may be removed. Carbons and porous cells should also be placed in water, after the nitric acid, if unexhausted, has been carefully poured into a bottle. The porous cells should be left in water for some hours, in order to have the zinc sulphate and nitric acid soaked out. If put aside and allowed to dry without this treatment, they will certainly crack. Binding screws should be examined for signs of bad contact, and any corrosion filed off. The carbons last for an indefinite time, as they are but little affected by the current. The zinc is slowly dissolved if the amalgamation is thorough.

It has been stated that the main objection to the Bunsen cell is the poisonous fumes; but these may be entirely avoided by employing a strong solution of bichromate of potash (as already described) in the porous cell, instead of nitric acid. The force is a trifle less, but there is no offensive smell.

The E.M.F. of the Bunsen is 1.90 volt. It is an admirable cell where a large continuous

current is necessary. Besides electric lighting, it is suitable for the electro-deposition of copper, silver, and gold, for working electro-motors and induction coils, and for making permanent magnets.

*The Fuller Cell.*—This cell is becoming very popular for small installations of the electric

The porous jar is charged with a solution of sulphuric acid in water. The outer jar contains the usual bichromate solution. To help in preserving the amalgamation of the zinc, an ounce of mercury is placed in the porous pot. The cell works well without attention for several weeks.

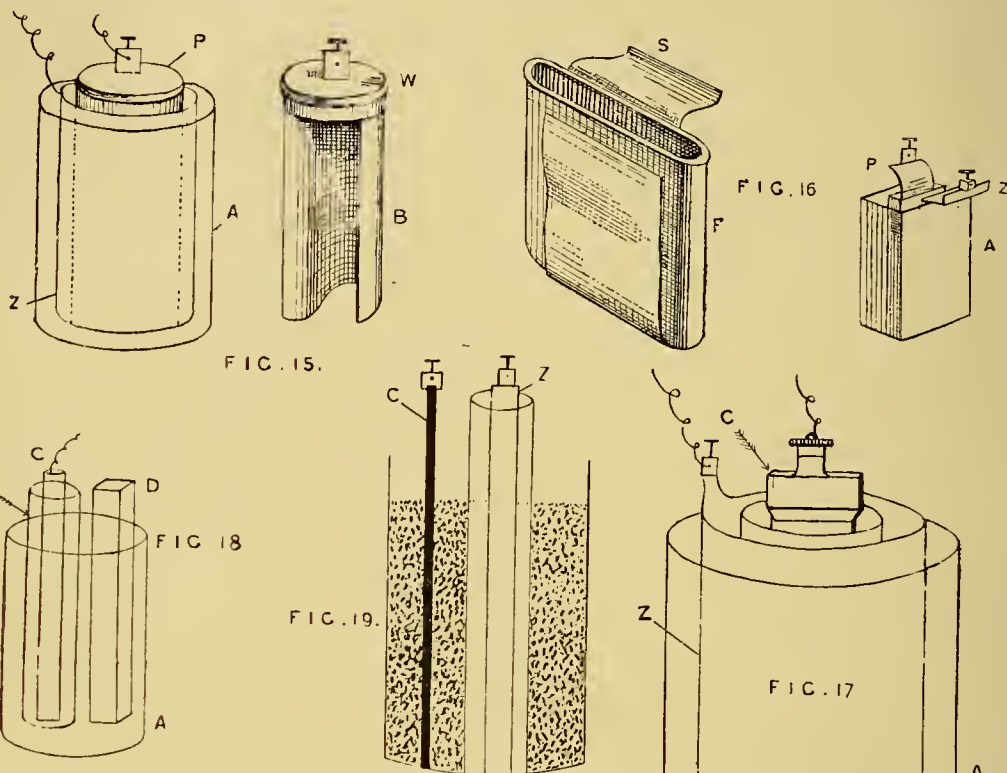


FIG. 15.—GROVE CELL.—A, OUTER VESSEL CONTAINING ZINC CYLINDER, Z; P, PLATINUM FOIL IN POROUS JAR; B, SHAPE OF PLATINUM FOIL; W, WOODEN LID. FIG. 16.—ANOTHER FORM OF GROVE CELL.—A, SQUARE OUTER VESSEL CONTAINING U-SHAPED STRIP OF ZINC, Z; P, PLATINUM FOIL IN FLAT POROUS POT; F, POROUS POT WITH STRIP OF ZINC, S, IN POSITION. FIG. 17.—BUNSEN CELL.—Z, ZINC CYLINDER IN OUTER VESSEL, A; C, CARBON BLOCK IN POROUS JAR. FIG. 18.—FULLER CELL.—A, OUTER JAR; B, POROUS POT; C, ZINC ROD; D, CARBON. FIG. 19.—GRANULE CARBON CELL.—C, CARBON IN OUTER JAR SURROUNDED WITH PIECES OF CARBON; Z, ZINC ROD IN POROUS POT.

light. It is free from fumes, and constant. It consists of an outer jar and a porous pot, the same as are used in the Bunsen cell. Fig. 18 will explain its construction. A is the outer jar, B the porous pot which contains the rod of zinc C, amalgamated, and about  $\frac{1}{2}$  in. diameter. D is a block of carbon about  $\frac{3}{4}$  by  $1\frac{1}{2}$  in., and 7 in. long.

Another arrangement of the exciting liquids is to place water only in the porous cell, and in the outer jar a stronger bichromate solution. The proportion may be 6 ozs. of bichromate crystals to a quart of water, adding  $\frac{1}{6}$  ozs. sulphuric acid. So charged, a battery of Fuller cells will give a powerful and constant

current for some weeks, working three hours a day.

*The Granule Carbon Cell.*—The peculiarity of this well-known cell is the employment of a large negative surface. An ordinary plate of carbon is used, but it is closely packed round with bits of gas carbon about the size of walnuts. Fig. 19 will explain the various parts. There are the usual outer and porous cells. The former contains the carbon plate c, surrounded with pieces of carbon. These must be packed closely to within an inch of the top. The zinc rod, z, is placed in the porous cell. The exciting liquids are made thus:—Bichromate of potash crystals are dissolved in cold water. For this operation patience is necessary, as the desired solution must be a saturated one. Have the crystals crushed before adding water. The crystals have to remain in water for about an hour, and be stirred a few times. After the final stir the solution is allowed to settle, and the clear liquid poured off. The charge for the outer cell is 2 parts of this bichromate solution to 1 part of muriatic acid. The charge for the porous cell is  $1\frac{1}{2}$  oz. of crushed sal-ammoniac, 1 oz. muriatic acid, and the cell filled with water to the height of the crushed carbon. One charge should work the cell for about six weeks; but if the zincs are removed from the porous jars when the cell is not at work, recharging so frequently as this may not be necessary. A small quantity of mercury is sometimes added to the porous cells, to maintain the amalgamation of the zincs.

The following may be given as suitable sizes for the several parts:—Outer jars, 8 in. deep by 6 in. diameter; porous jars, 9 in. deep by  $2\frac{1}{2}$  in. diameter; carbon plates (with binding screw attached),  $8\frac{1}{2}$  in. long by 2 in. broad; zinc rods,  $9\frac{1}{2}$  in. long by  $\frac{1}{2}$  in. diameter.

A cheap battery of granule carbon cells may be set up for electric lighting on a small scale. Six cells will feed an incandescent 5-candle power lamp, of low resistance, for many hours. After three hours' constant work the battery becomes weaker and the light diminishes, but strength is regained if the battery gets a rest. The muriatic acid gives off fumes, and, to avoid this, sulphuric acid may be substituted, with a slight loss of power. The granule carbon is an excellent cell

for sustained work where a powerful current is wanted. The cost of recharging is so small that it may be considered one of the most economical cells to use. It is well suited for long-continued experiments with induction coils, and for working medical coils and motors.

## HOW TO MAKE A BLOWER FOR SCREENING GRAIN.

By F. C. H.

(For Illustrations, see folding sheet presented with this Part.)

**N**CESSITY, the mother of invention, often compels us to do things we otherwise should not attempt: I have been a fancier and exhibitor of poultry, pigeons, etc., for over thirty-one years, and during that period have kept large numbers, which have consumed a great quantity of grain of all sorts. When you keep birds—pigeons especially—who eat a lot, it is much cheaper to buy peas, wheat, and other grain wholesale; that is, by load or quarter. Buying in dribblets at retail shops is very costly; but an amateur, not having storage, and especially a floor where he can shoot his grain, and who has to keep it in sacks, or casks, or bins, and do what he can to keep away damp, will find that the grain must be moved, turned over, and put through a blower, which cleanses, brightens, and improves the quality of the grain. In my earlier days, I was lucky enough to have a farmer living next door, who used to let me use his machines, but since that time I have often been distressed for a machine, as I did not, nor could, go to the expense of such large things. Once in my life, in a seed and corn store in Toronto, I saw a small one; the only time, and I have since been on the look-out fruitlessly. Well, not many months since, I saw a blower in a barn of a friend of mine, who consented to let me make a drawing of it, which I did, and constructed one half-size, and find it cleans the dust from grain very well, driving away mildew and damp. I have given the measurements as in the original; but anyone who tries to make one can do so to his own scale, and it will be found most useful to clean seed,



etc., and give a great deal of amusement in the making. It is not, in the true sense, a winnowing machine, having no side or sifting motion, but, by having sieves of different sizes, it could easily be made to do a lot of work effectually. I may state, for the benefit of amateurs making measurements from machines, the centre of the axles of wheels are the points to start from, and must be fixed with reference to each other, and the horizontal or ground line first. Thus, if a drawing has to be made of a railway truck, you would take the height of the centre of wheels from the ground, and the distance the centres were apart. The other measurements could be referred to these fixed points, with a certainty of being correct. The drawings will, I hope, explain themselves, with a few notes describing them. As they are made on a scale inch to a foot, any measure can be taken, and I shall be glad to explain anything not understood.

Figs. 1, 2, 3, 4 are the elevations of the two sides, back and front. The first thing to be done is to make the two frames, and then build up the sides, taking care that the axle holes agree in both sides of the front frame.

Figs. 5, 6 show the fan or blower, made of tin or zinc. Fig. 7 is the plan of the sieve, which is shown dotted in position in Fig. 1, and partly in elevation, 3, 4. At the back, in Fig. 4, will be seen the back of the hopper, with a screw to raise the lower portion to allow a large or small quantity of grain to fall on to the sieve. In the act of falling it is blown upon by the wind from the fan, which carries the dirt away, and the grain rolls down the sieve into a sack or on to the floor.

Should anyone wish to try his hand, he will find that the boxes in which large cheeses come from America will make the fan case; a piece of sheet zinc would do better, but will be more expensive. There is one thing I should point out, that the distance from bottom of hopper to sieve should not be reduced too much on a reduced scale, as the grain will have too small a distance to fall, and not be long enough under influence of the fan. Any points not clear I should be happy to explain. I suppose there should be a plan, but I do not see much would be gained by it, so I have omitted it.

## HOW TO MAKE-UP FOR THE STAGE.

By PROFESSOR LIONEL ARTHUR.

III. LADIES' WIGS, ILLUSTRATED AND DESCRIBED—  
"DRESSING" THE WIGS—STANDS AND BLOCKS—  
WHISKERS, BEARDS, AND MOUSTACHES—VARIETIES  
AND PRICES—ANTON'S PATENT WHISKERS AND  
MOUSTACHES.



LADIES, as a rule, are, I believe, both accomplished and expert in the matter of hair-dressing, and, as actresses, they do not have to wear wigs so frequently as men, except, of course, in companies where powder and costume plays comprise the best part of the repertoire. I shall need but little space to devote to their description. What I do write, however, will be more for the benefit of those unfortunate gentlemen who are called upon to play female characters in some extreme cases where members of the fairer sex are forbidden, by those straight-laced and sanctified members of the community, to intermingle with the actors, or take part in a performance. Of course, the comic old woman of burlesque pieces is a special line in itself, and these characters are usually great favourites with the low comedian of the company. Popular professional actresses seldom wear their own hair nowadays, but prefer some showy and expensive wig; but, still, there is frequently no necessity for this, and it is no doubt a mere whim, spiced with a good dose of vanity, that prompts them to cover up a good head of hair with a wig, which, however well made and adjusted, must always have an artificial look. But with amateur ladies and the more humble members of the profession, it is, as I have said, the practice to do without wigs as much as possible; and I quite agree with it.

Court wigs (Fig. 25) must always be worn in powder plays by ladies; these can be had of various shapes and designs; but the one here shown is usually adopted. Fig. 26 is the wig worn in such characters as Lady Teazle in the "School for Scandal." It is a wig which is frequently called into request in all the old English comedies. The "Grand Duchess" wig (Fig. 27) is also used in costume plays; this may be had in two colours, namely, white and golden. A wig each of the three varieties

named, would cover all the requirements of any ordinary actress as far as regards old English and foreign plays. In Fig. 28 will be found a very useful wig for special characters; it is called the "Débardeur," and the hair is white. Fig. 29 is the "Marguerite" wig, as worn by Miss Ellen Terry in "Faust," which was produced in such splendid style at the Lyceum Theatre a few years back. It is a very "taking" wig, and may, of course, be worn for many modern characters, especially in opera bouffe, etc. We next come to the curled or ringlet wig (Fig. 30). This is suitable for some old-maidish characters of a period fifty to seventy years ago, also many characters of a Dickensian type. This wig must be carefully handled and kept in good form, or it will soon come out of curl, and must then be sent back to the wig makers, as it is extremely difficult to re-dress, and requires a very skilful workman to do it properly. Fig. 31 is a type of the comic old woman's wig, with the hair brushed up behind, and tied in a topknot on the top of the head with ribbon. It is an extremely useful wig, and has been made very popular through being used by almost all comedians for the character of the "Widow Twankay," in the burlesques or pantomimes of "Aladdin." It can be ordered under the name of the character. I shall give illustrations later on of the make-up of some of these "comic old women" characters, in which will be shown other wigs of this class. As regards modern head-dress and wigs on the stage, the greatest favourite with the ladies at the present time is a wig of short wavy golden or auburn hair, as shown in Fig. 32. It is a very pretty and effective wig, and is, I believe, an imitation of the way in which Miss Eastlake wears her hair; a similar wig is worn by Miss Minnie Palmer, and her scores of imitators, in farcical and musical comedies. Fig. 33 is another very pretty head-dress, and is especially suitable for sober and dignified characters in the modern drama. Both these head-dresses are made by Mr. C. H. Fox, in the most careful and artistic manner. There are scores of ladies' wigs of all kinds and shapes, and amongst the most useful may be named the following,—Mrs. Candour, Pompadour (white), Marie Antoinette, Queen

Elizabeth, Nell Gwynne, Henrietta, Madame Favart, Galatea, My Sweetheart, Æsthetic, Rosalind, Viola, Portia, Juliet, Nan ("Good for Nothing"), Burlesque, Flowing Ballet, and wigs for all climes and nations, besides those for fancy dress ball head-dresses. In some characters where a cap is worn on the head, such as an old-fashioned landlady, it is not necessary to wear a wig, but only a "front"; these can be had to suit such characters, and cost about 3s. 6d. each; they tie on with black tapes which are hidden by the cap.

With constant usage wigs get out of order, and consequently have to be re-dressed; this is especially the case with ladies' wigs, which require to be put on the block every time before use. A good many professionals know how to dress their wigs, and keep them in a proper condition; and if anyone intends "going in" for a large stock of these articles, I would certainly advise him to learn from some one in the trade a few secrets regarding the art of "board work" (the technical name for wig making). If he cannot follow out this advice in its entirety, he can at least learn the knack of combing his wigs, and so giving them a decent appearance. For this work he merely requires a wig block and stand, and a brush and comb. The most simple form of wig block is shown at Fig. 34, which has a hole in the bottom part for slipping on to the stand, Fig. 35. This stand, as will be seen, is made to screw on to the side of any table, and it can also be used for dressing any kind of hair upon. A more improved form of wig block, which will stand upon the artist's dressing-table, is that shown at Fig. 35. This has the advantage also of working in a ball socket, and held firm by thumb-screws, and can therefore be adjusted in any position which is most convenient for the user. Before using, wigs should always be put on one of these blocks, and properly dressed with brush and comb. If a wig has to be curled, the curling-irons are heated and used in the ordinary way, taking care not to have them too hot, so as to injure the wig. I have already given directions for packing wigs away; and if these are carefully followed out, it will save a lot of time in getting through the work I have just mentioned.





FIG. 32.



FIG. 29.



FIG. 33.

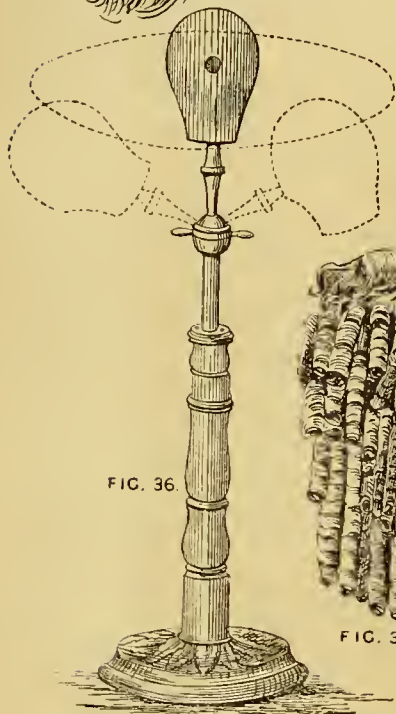


FIG. 36.



FIG. 30.

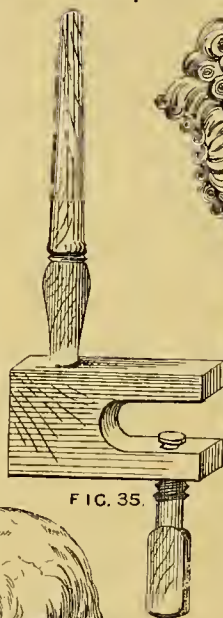


FIG. 35.



FIG. 26.

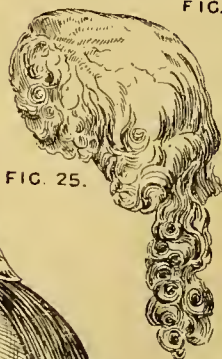


FIG. 25.

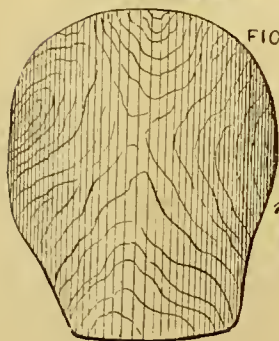


FIG. 34.

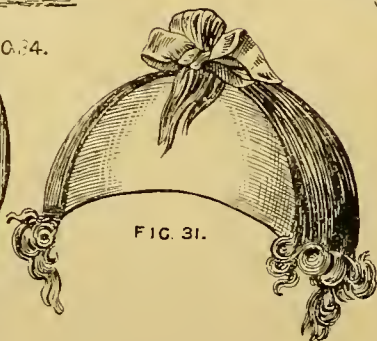


FIG. 31.

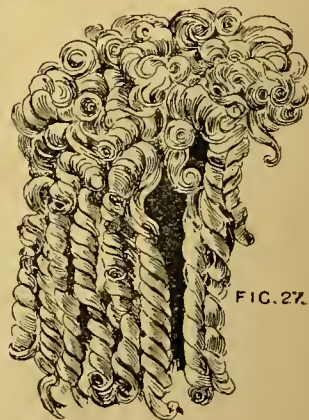


FIG. 27.





DESCRIPTION OF FIGURES.

- FIG.  
 25.—LADIES' COURT WIG.  
 26.—LADY TEAZLE WIG.  
 27.—GRAND DUCHESS WIG.  
 28.—DÉBARDEUR WIG.  
 29.—MARGUERITE WIG.  
 30.—CURLED WIG.  
 31.—COMIC OLD WOMAN'S WIG.  
 32.—FOX'S FASHIONABLE LADY'S WIG.  
 33.—DITTO.  
 34.—WIG BLOCK.  
 35.—ORDINARY WIG STAND.  
 36.—IMPROVED WIG BLOCK AND STAND.  
 37.—SHORT FULL BEARD AND MOUSTACHE.  
 38.—DITTO DITTO ANOTHER SHAPE.  
 39.—LONG FULL BEARD AND MOUSTACHE,

- FIG.  
 40.—BEARD WITHOUT MOUSTACHE.  
 41.—SIDE WHISKERS AND MOUSTACHE.

*Whiskers, etc., on Wire.*

- 42.—SIDE WHISKERS AND MOUSTACHE ON WIRE.  
 43.—SHORT SIDE WHISKERS AND MOUSTACHE ON WIRE.  
 44.—FULL BEARD AND MOUSTACHE ON WIRE.  
 45.—DUNDREARY SIDE WHISKERS ON WIRE.

*Side Whiskers on Gauze.*

- 46.—MUTTON-CHOP SHAPE WHISKERS ON GAUZE.  
 47.—VARIOUS FORMS OF MOUSTACHES.  
 48.—METHOD OF ATTACHING MOUSTACHE WITH WIRE SPRING.  
 49.—CHIN PIECE FOR FRENCH AND YANKEE CHARACTERS.

*Whiskers and Moustaches.*—A good make-up is often rendered effective and complete by the successful and artistic adjustment of the whiskers or the moustache and beard, whilst, on the other hand, it may be completely spoiled or very much marred by these hirsute appendages being stuck on in a rough, clumsy, and unnatural way. In order to "make-up" in a natural and artistic manner, the young actor must bestow much thought and practice in the preparation and wearing of the hair about the face. The best forms of beards, whiskers, etc., which are sold ready made are those that are knotted on gauze; these are either attached to the skin with spirit gum, or by an invisible wire spring fastened behind the moustache, etc. A more expensive moustache, still, are those which are made on a hair-net foundation, and which cannot be detected from the real thing itself. The cheaper form of whiskers, etc., are those that are made upon wires; but these, I need hardly say, are never worn by our professional actors. They are, nevertheless, very useful for amateurs, and for quickly making up a host of supers or a chorus. These, too, are made in two qualities with human and imitation hair. A great many actors make their whiskers and moustaches themselves, out of crêpe hair or German wool, and after the evening's performance they simply pull this off and throw it away, using fresh every night. This I must say is the simplest and least expensive plan, as the crêpe hair is so exceedingly cheap that it is not worth the trouble of saving, although it may frequently be used more than once; whilst with moustaches, etc., on gauze and hair-net foundations, they soon become matted with spirit gum, and too rough to be of any further use. I shall describe in its proper place the method of working up the crêpe hair and drawing it into shape, contenting myself here with describing the different kinds of whiskers, moustaches, etc. German wool is a new introduction into this country, and is now used largely, I believe, by Mr. Hermann Vezin and other well-known actors. Coming to the description: Fig. 37 is that known as a short full beard, Fig. 38 is another shape of the same, whilst Fig. 39 is a full long beard all these have moustaches, but

Fig. 40 is a beard without moustache. Figs. 41 and 42 are side whiskers and moustache combined. Fig. 43, short whiskers and moustache. Fig. 44, another form of full beard and moustache on wire. Fig. 45 shows a pair of side whiskers on wire, and Fig. 46 a pair on gauze, unttou-chop shape. The various forms of moustaches are shown in Fig. 47, and the method of attaching them by means of a wire spring in Fig. 48. The following are the prices of beards, moustaches, and whiskers, at C. H. Fox's depôt:—

Beards and moustaches on wire, ordinary, 2s. 0d.; ditto, very full and long, 2s. 6d.; sailor's beards, 1s. 0d.; beards without moustaches, very long, white and grey, 3s. 6d.; beards, best knotted, on gauze, all colours, 2s. 6d.; ditto, on gauze, with invisible spring, 4s. 6d.; ditto, ditto, with moustache, 7s. 6d.; whiskers on wire, 1s. 0d.; ditto, and moustache, 1s. 6d.; ditto, Dundreary, 2s. 0d.; whiskers on gauze, 1s. 0d.; ditto, with invisible wire, 2s. 6d.; moustaches on net (common), 6d.; ditto, on gauze (superior), 1s. 0d.; ditto ditto, with spring, 1s. 6d.; ditto, on hair net foundation, best make, 2s. 6d.; Imperials, 6d.; ditto, large, 1s. 0d.; chin pieces, 1s. 0d.; eyebrows (to stick on), per pair, 1s. 0d.; ditto, on gauze, to go across forehead, and fasten with elastic, per pair, 2s. 0d.

Crêpe hair may be had, in every possible colour, at 6d. per yard. Some of the most useful colours are light and dark brown, golden, red or ginger, black, white, grey, iron grey, etc., etc. Mr. A. Homburg, of 8, Briggate, Leeds, is agent for G. Anton's Berlin patent beards, whiskers, and wig mounts; and he will send his catalogue, I believe, to anyone on receipt of four stamps, its published price.

(To be continued.)

AN EXCELLENT WAY TO MEND BROKEN PLASTER CASTS and impressions, is to paint the broken surfaces over two or three times with very thick shellac varnish, and at each application to burn out the alcohol over a flame. When the shellac is sufficiently soft, press the parts together, and hold in position until cool.—*Scientific American.*



## HOW TO MAKE NETS.

By W. BUCHANAN.

## I.—DESCRIPTION OF MATERIALS REQUIRED—WHERE TO BUY—INSTRUCTIONS FOR MAKING A LANDING NET.

 O those who are fond of doing things for themselves, a knowledge of netting will frequently be found useful, and will also form a pleasant recreation in spare moments. It does not require continuous application, but may be laid aside, and taken up again, as time offers, without any damage to the work. It is not difficult to acquire, not easily forgotten, and is capable of being applied to many varied purposes. From large fishing and trammel nets, nets for tennis, hammocks, rabbit snares, protecting seed beds, poultry runs, landing and prawn nets, etc., down to those for enclosing a lady's hair, the method of making is the same, and the amateur after mastering the stitch can make them all without difficulty. He is not likely to need a large fishing net, but he may have frequent use for smaller ones about his house and garden.

The materials required are few and inexpensive, consisting only of needles, mesh sticks, and twine. Needles are made of hard wood or metal. Wooden needles are shaped as Fig. 1, and are 6 to 9 inches long. These are used for large meshes, or anything over  $\frac{1}{2}$  inch square. The twine is fastened with two half hitches round the tine, and is then wound over the end, and round the tine, from side to side, until a sufficient supply is on. Fig. 2 gives the shape of steel needles used for small work. They are about 9 inches long. The twine is passed through the hole and tied, and is then wound on, between the points at each end. In making small meshes care must be taken not to put too much twine on this needle, or it may not pass through the loops. The needles cost from 1d. to 6d. They will last for years, and one of each will be enough for our purposes.

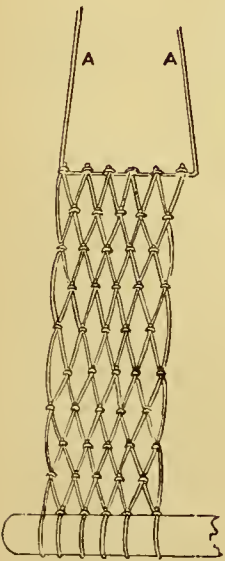
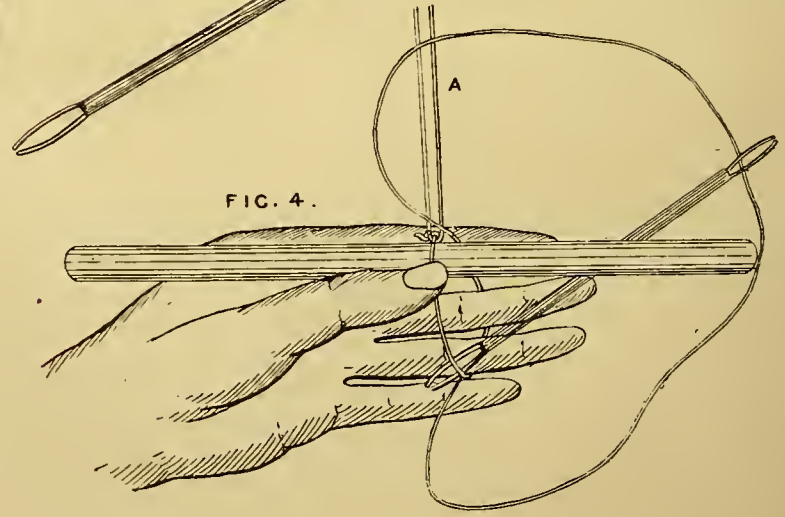
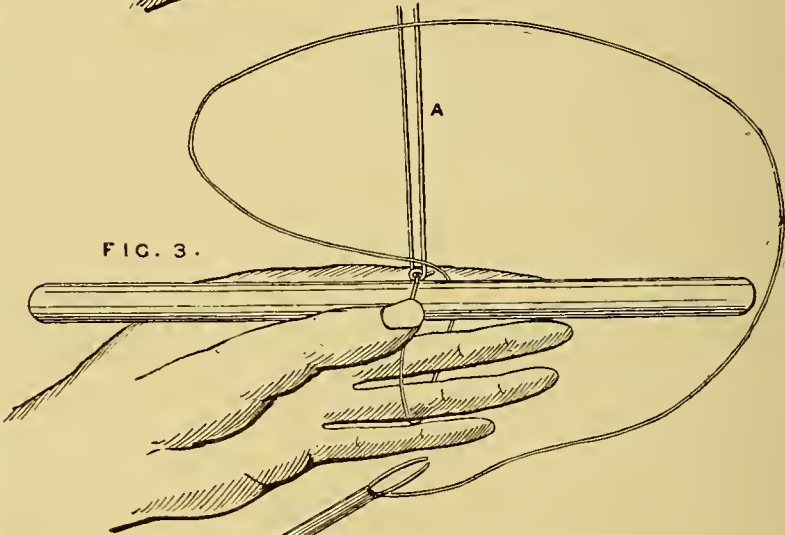
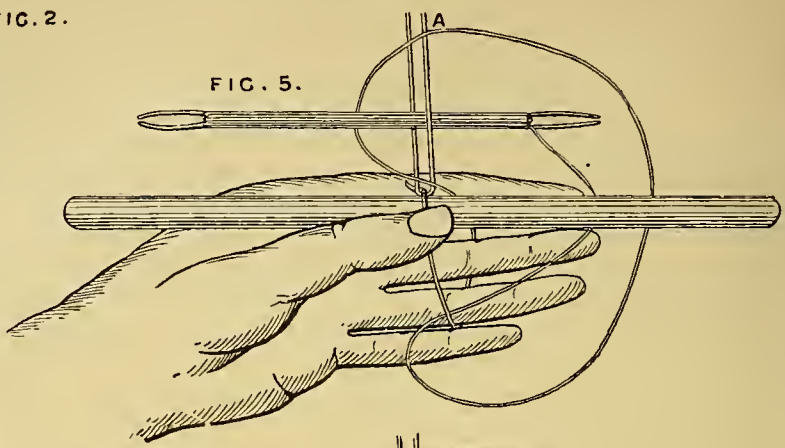
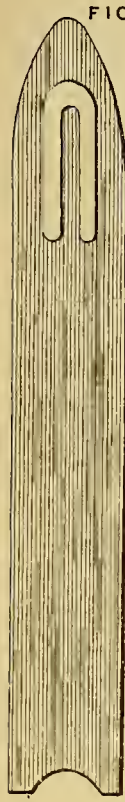
The mesh sticks are slips of hard wood, such as box, which is very suitable, 6 to 8 inches long,  $\frac{1}{8}$  to  $\frac{1}{2}$  inch thick, and varying in width according to the size of mesh, from  $\frac{1}{4}$  inch up to 10 or 12 inches. In the latter case they would

have to be a little longer than the width, and also a little thicker than the small ones. For finer nets they are made of metal or ivory. All the edges of the stick should be carefully smoothed with a file, and no sharp corners left to injure the twine. It must be of the same width throughout, to secure uniformity in the size of the mesh. If it is wider in one part than another, the meshes will vary accordingly, and the net will be unsightly. After procuring one needle and stick, which are all the tools necessary, the twine remains the only element of cost in a net. It is now made so cheaply and of so many different qualities, that there is a wide range to suit the fancy or the pocket. In almost every large town there are makers of twines more or less suitable, and the prices will run from 1d. to 2s. or 3s. per hundred yards, according to thickness and quality. In purchasing, see that it is level, *i.e.*, of uniform size. If it varies in thickness it will be more difficult to net. The Manchester Cotton Twine Spinning Company, Levenshulme, Manchester, make a considerable variety of cotton twine and cord for salt and fresh water use, plain and waterproof, and are very obliging in sending samples of anything wanted.

The circumference of the mesh stick is generally known as the size of the mesh. Thus a stick 1 inch wide will make what is called a 2-inch mesh, *i.e.*, the mesh can be stretched 2 inches in a straight line. This is a little confusing, but if we remember that the width of the stick is the width of each side of the mesh from knot to knot, all confusion will be avoided.

*Landing Net.*—We will now proceed to make a landing net, choosing this because it is a little more difficult than other nets, and will probably be an interesting net for many of our readers, especially if they be fond of the gentle craft. The same instructions will apply to all nets in the shape of a bag or purse; they are all made in the same way. Having procured suitable twine or cord, the first process is to net a small square, which forms the bottom, and the net is gradually built up on it. The angler may make his net of good serviceable twine, to cost from 3d. to 6d., or he may use the best waterproof cord, costing up to 1d. per yard, or more. After





he has dressed the cheaper net with a waterproof solution at a trifling cost, it will last a long time. The satisfaction of landing the speckled trout, "beautifully bedropped wi' crimson hail," in his own net, will be ample reward for his trouble.

inch square will be a suitable size, and the stick must therefore be  $\frac{1}{2}$  inch wide. Get a piece of strong thin twine 1 yard or so long, knot the ends together, and pass it over a hook fixed in the wall, or round the leg of a table, or over the operator's foot; I find the latter a very con-

FIG. 10.

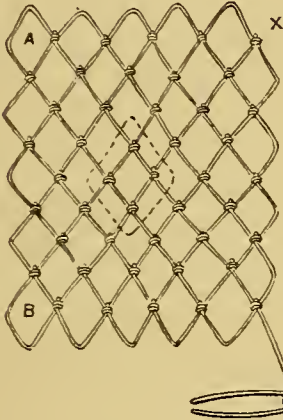


FIG. 8.

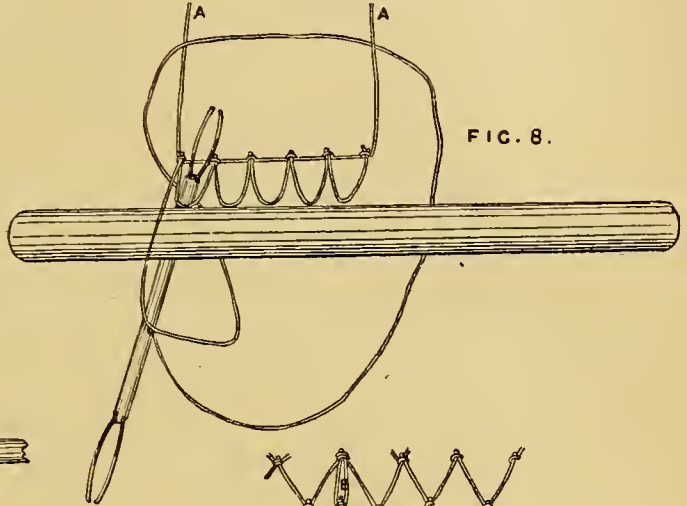


FIG. 6.

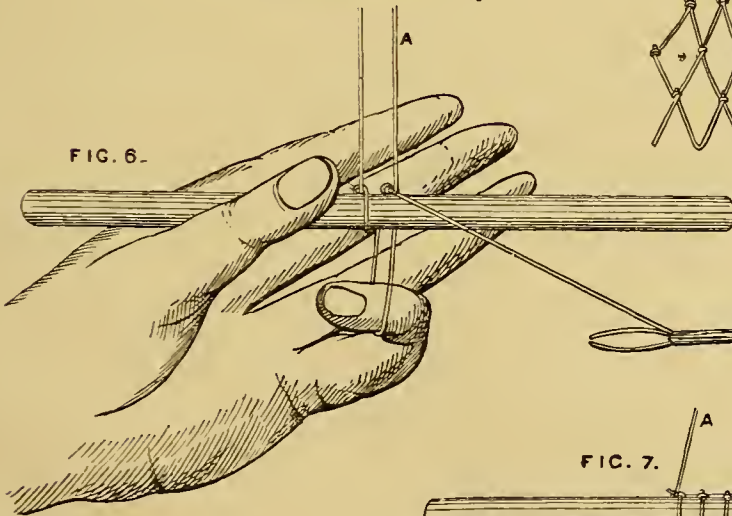
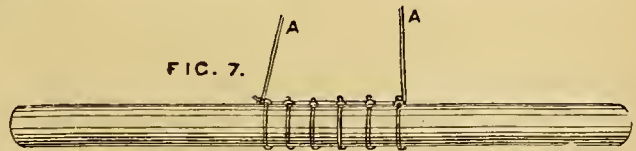


FIG. 7.



The bottom may be a square of any size, from 4 to 20 inches or more, according to the desired shape of the net. With a large square it will be rounded, with a small one it will be more pointed. We will suppose this net to be made on a square of 5, and that it is to be 12 inches in diameter, and 18 inches deep. A mesh  $\frac{1}{2}$

venient plan. The first row of loops is netted on this cord, which is afterwards removed. The knots are then drawn out, making the loops slightly larger. Therefore it should be as thin as possible, yet strong enough to bear a steady pull. Having filled a needle with twine, tie the end of it to the cord, place the mesh stick

against the knot, keeping the cord taut with the foot. Bring the twine over the mesh stick, round the second and third fingers, and back behind the stick, as in Fig. 3, throwing the twine clear in a large semicircle. The loop is now held in position by the thumb in front, and the forefinger behind the stick. Now pass the needle through the loop from left to right, behind the stick, and through the opening of the cord from beneath, as shown in Figs. 4 and 5. It is really one movement, as in Fig. 8 further on, but I have divided it here for the sake of clearness. There are now two loops, the end of the second resting on the little finger in Fig. 5. Catch hold of this loop with the little finger, and slip the other two fingers out of the first loop. Then pull the twine towards you, keeping the cord taut with the foot, and the mesh stick close to the knot. Get the first loop tight round the stick. If the twine is smooth it will pull tight easily, if hard or rough it may require a little coaxing, which after some practice, is done rapidly by the second and third fingers pressing against the large loop while pulling it through. Do not let go with the little finger till the first loop is tight, the slack twine of the large one pulled in, the mesh stick close to the first knot, and the new knot just appearing over the top of the stick. Then, when all the twine is in except an inch or so, see Fig. 6; and having an equal pressure on both sides with foot and hand, you may let go and pull tight. The second knot should then be just on the top of the stick, level with the first. If it come over the stick, it is a slack mesh, slightly larger than it ought to be.

Though it takes a little time to show this, twenty stitches could be netted while describing one. It can be done very quickly when the stitch is mastered. After the learner has made a dozen meshes, and keeping in view all the points mentioned, he will be able to go on with ease, and before he has done a hundred, he will net as merrily as a blind woman knitting.

Proceed now to net four stitches exactly similar to the first. Fig. 7 shows the stick after that is done, but the knots and loops will be close to each other. I have shown a little space between each to make it plain.

Remove these loops from the stick, and turn them over, so that the twine is on the left side. In Fig. 8 you will see the position of the twine, and the appearance of the loops after they are turned over and stretched out a little. They have to be turned after each row is finished, because it is more convenient to do this stitch from left to right. Turn the foot cord at the same time, to avoid twisting. There is another method, which may be done in the opposite direction, but it involves two movements of the needle, and is not so simple as that described.

The second row of loops will now be done. Place the stick in the position shown in Fig. 8, bring the twine over the stick, making the loop round the fingers and behind the stick, and throwing the twine clear, as already described; then pass the needle through the loop from left to right, behind the stick, and through the first loop in the row from beneath (see Fig. 8), and knot tight as before. The second stitch is made through the second loop, and so on to the end of the row.

Then turn over as before, and do the third row, and so on until there are ten rows of five loops each, when the net will look like Fig. 9, but the knots will be touching each other.

Remove the stick from the last row, untie the foot cord, and draw it out of the first row of knots. These knots will now come out, leaving the loops slightly larger. Stretch out the net, and you will find it is a square of five meshes, as in Fig. 10. Cut off the loose end of twine which was first tied to the cord, close to the knot where it is marked x.

Before the learner has reached this point, he will probably have broken the twine. With ordinary care, this very seldom happens; but when it occurs, Fig. 11, c, shows the best method of joining. It is the ordinary sailors' bend, or weavers' knot. The same knot is used in joining the end of a new needleful of twine to the last one. In all cases it should be made close to the previous knot. In Figs. 3, 4, 5, 6, 7, 8, and 9, A is the foot cord.

Now get a thicker foot cord, strong and soft, and pass it through the centre squares, marked with dotted lines (Fig. 10), and over the foot as before. Then place the mesh stick in the



same position as Fig. 8, and go round the net twice, stitching through each loop in succession, which adds one mesh to it all round. Note that the corner loops A and B, Fig. 10, are half as large again as the others, and require each two stitches to take them in. Be careful not to miss a loop, or the net may be spoilt. Suppose this happens; you must untie the knots till you come to it. If this cannot be done without injuring the twine, then cut the loops off at the knots, make a join, take in the missed loop, and proceed. But if the netter is attending to his work, it will never happen.

It is now time to begin letting out. This is done by making two stitches in one loop. At first it is well to let out freely, and afterwards to reduce the proportion as the net gets wider. Therefore, let out one in five; that is, after stitching through five loops, make another stitch in the fifth loop. Fig. 11, A, shows such a loop, which is half the size of the others; and B in same Fig. shows a previous loop netted in. It makes a small mesh by itself. In doing the first round, one might be let out between each corner, then two plain rounds, then one round, letting out one in five, and two plain rounds. On the next round let out one in five, then two plain rounds. Repeat this again. The size and progress of the net may easily be seen by spreading it on the table, or by counting the rounds and loops. It is now about 38 loops, or 19 inches, in circumference, and about 8 inches deep. On the next round let out one in six, then two plain rounds, and repeat the same twice. It is now 60 loops, or 30 inches round, and about 12 inches deep.

Nothing should be let out on the last 4 or 5 inches, and the full circumference of 72 loops should be reached when the net is about 14 inches deep. Therefore, on the next round let out one in seven, add two plain rounds, and on the next let out one in four loops only, which gives the full circumference, 72 loops, or 36 inches. Add eight or ten plain rounds, making it about 18 inches deep, and the net is finished. The last two rounds might be done with a stouter cord, as they bear the strain and friction on the ring. When the net is a few inches long, the foot cord should be passed through a

round higher up, to relieve the pressure on the bottom squares.

There is an alternative method of making such a net, which would not look well in a landing net, but is less troublesome, and might be useful for any rough purpose. Suppose the net to be of the same size and mesh as that just described, the process is simply reversed. Begin with 72 loops on the mesh stick, make the 73rd stitch through the first loop, do eight or ten plain rounds, then take in by passing the needle through two loops instead of one. First take in one in nine; that is, pass the needle through every tenth and ninth loop in one stitch. Do one round in this way, and two plain rounds, then one round, taking in one in seven, and so on till the net is long enough, and the circumference reduced to a few loops, which are all tied together firmly.

*(To be continued.)*

## A WINDOW ORNAMENT.

*By C. MAINARD WALKER.*



NOTHING, to my mind, gives a prettier finish to a nicely curtained window than a suitable suspension basket, or other receptacle, in which flowers, ferns, or creepers may be cultivated. As the reader knows, something answering to this description can be purchased, from the common wire article, "all made to fold up," at a penny each, to the costly and artistically decorated china vessel, lately becoming very fashionable, so that if he be desirous of adding to his possession in this line, he has not far to go. But probably the intelligent "hobby rider" would much prefer to have something which can be made at home, and which will incur some little "labour of love," and subsequently afford him some honest pride in its possession. With the view of helping such, the writer submits the design (Fig. 1) of a suspension basket which is at least quite outside the beaten track of such things, is easily made, costs but a few pence (plus labour), fulfils its object in use, and is very effective in appearance. The one from which Fig. 1 is taken

measured  $10\frac{1}{2}$  inches across top by 9 inches on the side; but, of course, any size could be made. In my own case, a pair of these balanced a much heavier affair which hung in the centre of a bay window; hence the small measurements. The basket consists of a zinc cone  $6\frac{7}{8}$  inches wide by  $6\frac{1}{2}$  deep, encased by four scrolls cut with fret-saw from  $\frac{1}{2}$ -inch pine. Fig. 2 is a full-sized pattern of the scroll, of which four will need to be cut; as also one of Fig. 3, for the base piece. Having cut these out, sand-paper them up smoothly, and lay aside for the present. The cone is made of sheet zinc, about No. 10 gauge. If the reader can solder he can make this easily, but comparatively few persons know how to set out a cone in sheet material; so permit me to describe the way it is done, applicable to all sizes and materials. A cardboard lamp shade, for instance; Fig. 6 illustrates this, and is shown on a small scale for economy of space. Suppose it is desired to strike a cone which shall be, when made up,  $1\frac{1}{2}$  inch at its base by  $\frac{7}{8}$  at its narrow end, by  $1\frac{3}{8}$  deep at the side.

First draw a centre line A B, then across draw a line C D  $1\frac{1}{2}$  inch long, and at a point at a distance equal to the desired side of cone draw E F  $\frac{7}{8}$  inch long; draw a line level with the ends D F, and bisecting the centre line at G, a similar line from C to G, then with the compasses describe a circle with G as its centre, intersecting C and D, and a smaller circle from the same centre, intersecting E and F. Next

describe a half circle, with B as its centre. Now to find how much material you want, measure with the compasses this half circle; you will want just double its dimensions, plus any overlap you may want in making a seam. In the diagram the segment of the circle between the two Xs would be required. For the purpose of



FIG. 1.—THE WINDOW ORNAMENT COMPLETE.

Fig. 1 you will want a cone  $6\frac{7}{8}$  inches wide, by  $\frac{3}{4}$  inch at its lower end, by  $6\frac{1}{2}$  inches deep; proceed as described; solder up neatly, and also solder in a  $\frac{3}{4}$  inch circle at bottom. File the work up clean, and, in order to give as much rigidity to the sides as possible, the edge should be neatly hammered over to the inside, say,  $\frac{1}{8}$  of an inch. Turn the cone upside down, and mark where each of the four scrolls will come. Bore a small pin-hole in the zinc, and a corresponding one in each scroll (see Fig. 5). Pass an ordinary brass pin through the zinc and through the wood, bending over at the wood end with the pliers, till the projecting piece is buried flush with the surface. This is easily done. Have ready your base piece; tie a piece of string round the four scrolls to hold them into

position, and, with the hot glue, press down the base piece at the point B on each. When set, turn the work over, cut off the pin head nearly close to the zinc, and solder at that point. This makes all secure. Also insert a pin through base piece and scroll, at B, Fig. 5. Bore a hole in the small end of cone, and solder in a brass knob, to be obtained at most furnishing ironmongers. Attach four S hooks at edge of zinc through





holes, midway between scrolls. Paint any colour: Aspinall's French grey is very suitable, and harmonises well with the colour of ferns, etc. When painted and dry, connect a length of brass chain to each S hook (about 10 or 12 inches) and another S hook at the point of suspension. A suitable fern for this basket can be obtained for a few pence, and a root of common ivy of the non-clinging variety will, in a very short time, add some very graceful lines to the whole. The writer has a beautiful specimen of this kind in a window basket, which was gathered from the hedgerow, and is at all seasons of the year in a state of luxuriant green; and no prettier decoration could be wished for.

## AMERICAN ORGAN BUILDING.

By THOS. L. WINNETT.

### VI.—SUB-BASS ACTION—FITTING UP SUB-BASS BOX—CAVITIES—PALLETS—ACTION RAIL—LEVERS—CONNECTING TO KEYS.



I will now return to the inside work of our instrument, to consider that charming and effective addition to an American organ, *i.e.*, the sub-bass action. It consists of a set of thirteen large scale reeds of 16-foot tone, so placed on the sound board, and in connection with the bass keys as to produce a very rich and full tone to the organ, not unlike that of the church organ. No American organ may be considered complete without this valuable addition to its power. When brought into action by means of the bass portion of the octave coupler, the effect can only be imagined by those who have heard such an instrument; of course it may be omitted from our specification, but the extra cost being so small, 7s. or 8s., and the utility of the addition being so apparent, I need hardly press upon you the desirability of having it. Besides, if you intend having an octave coupler, the treble portion being so doubled, you will require something heavy in the bass to counterbalance, or the effect will be a little more treble than is necessary.

The sub-bass box (Fig. 46) consists of a hollow block of beech or other hard wood, perforated with thirteen cavities, each of which

is occupied by a reed, and which is inserted into the box from the top. When fitted for action, a hinged pallet covers the mouth of each cavity, and is opened and closed by the tail end of long levers, actuated by the manual keys. I must refer you to Fig. 42 for a detailed description of the action. No mute is needed, as in the case of the other sets of reeds, the pressure of the atmosphere outside serving the purpose of keeping the pallet closed. The action is exceedingly simple, and no amateur used to careful work need be afraid of not being successful in the task of making one. At the same time I may tell you that Mr. Marsh will supply the box complete, with the exception of the pallets and top rail, for 7s. 6d. If the saving of a shilling or so is of little consequence, and the spare time is of more importance to us, then I should advise the purchase of the article complete. But if ready cash be scarce, as it often is in these hard times, I can show you a plan whereby one-third of this amount at least can be saved, *i.e.*, by purchasing the reeds only, and making the sub-bass cavity box for the reeds to fit into. The reeds may be obtained either of Mr. Marsh or the American Organ Agency, London, for a reasonable price.

First obtain a block of beech well seasoned,  $\frac{7}{8}$  in. thick, 14 in. long, and  $4\frac{3}{4}$  in. broad (A, Fig. 45). Plane it up nicely to the measurements given, making the sides square. Now mark the side of the block where we intend to cut the cavities (letter c), and cut off the three corners D, E, and F, as shown by the dotted lines in Fig. 45. If you place the block in the position shown in the illustration, that is, with the corner D resting on the ground or table, as the case may be, you will easily see if the corners have been cut right. The part cut off at F should be exactly parallel with the base D; and the part E should be at right angles with the ground. Place the block with the side c upwards, and arrange the thirteen reeds on the top in the position in which the cavities are to be cut, equidistant from one another. Fig. 44 will show you better than I can explain, but be careful to begin with the largest reeds at the end which is to be the bass end of the organ. As a guide for marking out correctly, I might

mention that each reed must be in a line  $\frac{1}{8}$  of an inch from the end of the bevelled side *r*, and the distance between each reed should be rather more than  $\frac{1}{2}$  an inch. Having traced on the block with pencil the shape of each reed, the cutting of the cavities may be commenced. As the cavities must be smaller in width than the reeds, we must take a  $\frac{1}{2}$  inch centre-bit, and bore out the circular part of the thirteen cavities with holes  $\frac{5}{8}$  inch deep. Continue these holes to the edge of block with a tenon saw, and cut out the remaining portions with a  $\frac{1}{2}$  inch chisel. A rabbet of the depth and width of each reed must now be cut all round each cavity, and each reed will have to be fitted into its own rabbet, so that the surface of the reeds, when all fitted, should be but the thickness of a piece of writing paper above the surface of the block. Then, when a piece of veneer is glued over the cavities we have made, the reeds, when inserted from the front opening, will slide tightly in the grooves thus formed. Of course, in placing the reeds in the cavities, the lettered side must be uppermost, that is, it must face the roof of the cell. Care must also be taken, when fitting the reeds, that their ends go well inside the mouth, or they will be in the way of the pallets which close the opening.

The piece of veneer forming the under surface of the cavities (Fig. 44, *b*) must of course be cut the same size as the under surface of the block. The pattern and position of the holes to be cut must be found by previously placing a sheet of paper over the cavities, and taking an impression in the same way as the pattern of fret work is taken. The width of the holes, however, must not be more than  $\frac{1}{2}$  an inch, the diameter of the *inside* of cavities. Glue the veneer over the cavities, leaving it to dry under a heavy weight. The part *b* must now come under consideration. Another block of beech must be obtained of the same length as the first, but  $1\frac{1}{2}$  inch thick, and  $3\frac{1}{8}$  broad (*b*, Fig. 48). There is nothing difficult to do to this one. Square the sides and ends, and at *c* cut off a corner (see illustration) for the top part of the cavities to fit on to. The ends of the block must be planed quite true, so that when the two sides (*d*, Fig. 48), are fixed against them, there

may be no leaks through imperfect fitting. The construction of *d* needs no description. Thin  $\frac{1}{2}$  inch beech, planed down to  $\frac{3}{8}$ , is the thickness of wood to be used, and, as I said before, the sides must fit *perfectly* on to the ends; four screws have to be put into each side after it has been glued. Be careful that the two blocks fit nicely together on the bevel *c*. It would perhaps be as well if this part were glued and fixed before the sides are put on; but I leave it with you to finish in a workmanlike manner, after you have once got the idea.

Before leathering the bottom of the block we must see that it stands quite true on the reed board. The position it is to occupy will be seen by referring to Fig. 49. Five  $\frac{3}{4}$  inch holes must be bored through the reed board, to connect the reeds with the reservoir. The screwing down must be made from underneath, using half a dozen  $1\frac{1}{2}$  inch screws; but make quite sure of the right position of the box before screwing down; the front of the box should be nearly 9 inches from the line of plungers connecting the keys to the action, and the box must be shifted along sideways until the second lowest note is in a straight line with the second manual plunger. When this position has been found, the box may be screwed down.

The pallets next must have our attention (Fig. 47). Cut them out after the manner described for the manual pallets, *i.e.*, from the end of  $\frac{3}{4}$  plank planed down to  $\frac{5}{8}$ ; two pieces must be cut  $2\frac{1}{2}$  inches long, to be again cut into pallets  $\frac{1}{8}$  of an inch wide. A reference to page 98, Part 15, where the process is more thoroughly detailed, will make this plain, if there be found any difficulty. Fig. 47 shows a pallet in section, exact size. You will observe that its shape is not the same as the manual pallets, but is bevelled at the back end. This bevel is to have the half of a strip of leather, 1 inch wide, glued on to it to form a hinge, the other half to be fixed to the rear of the box (see *h*, Fig. 42). Each pallet must be leathered underneath with sheepskin or washleather. Fourteen guide pins will be wanted to separate each pallet, and to make them work straight. The front line of the pallets will overlap the



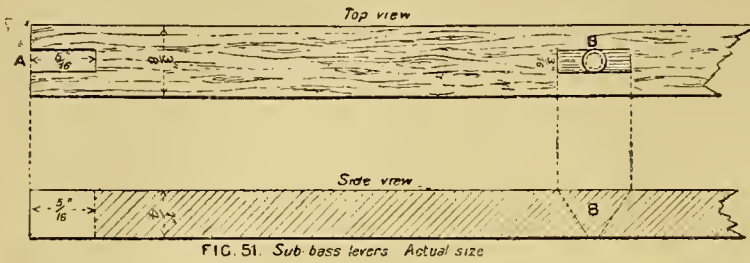


FIG. 51. Sub-bass levers. Actual size

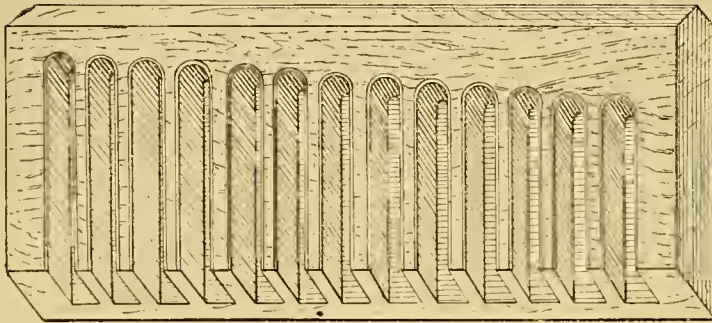


FIG. 44. Sub-bass Cavities

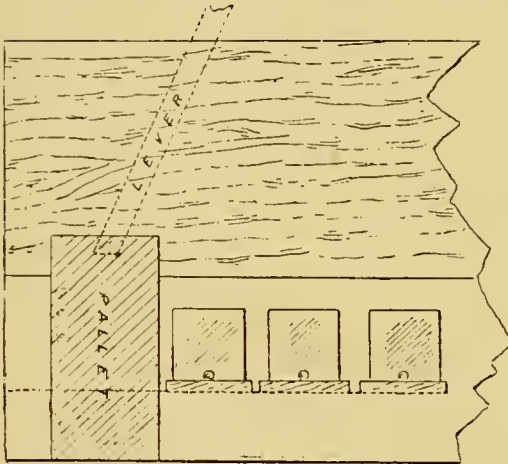


FIG. 44 C. Sub-bass box viewed from the top.

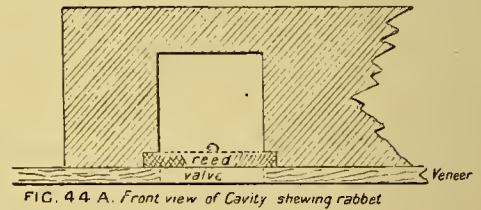


FIG. 44 A. Front view of Cavity showing rabbet

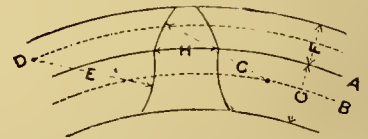


FIG. 44 B. Plan of Veneer, forming under surface of Fig. 44.

top of the sub-bass box quite  $\frac{1}{2}$  an inch; this is in order that the lever D (Fig. 42) may lift it up when the corresponding manual plunger is pressed down. The only thing remaining to be done is to make a rail  $14\frac{1}{4}$  inches long, supported at either end by two plain brackets, fixed upon the ends of the sub-bass box; the rail is to keep the pallets from throwing over, in case of too energetic a touch being given to the lever, or in case the organ should be turned over while removing it from

one place to another. It is shown in Figs. 42, 46, and 48, and is so simple as to need no detailed description beyond the fact that the under surface of the rail must be felted to ensure silent action should the pallets touch it.

We will now proceed to make the action rail (E, Fig. 41). Prepare a slip of seasoned beech 10 inches long, 3 inches broad, and  $\frac{1}{4}$  inch full thick. After planing up, carefully mark off from one of the long sides  $\frac{1}{4}$  inch, and bevel the edge up to that distance (see Fig. 43).



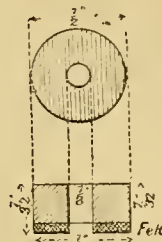
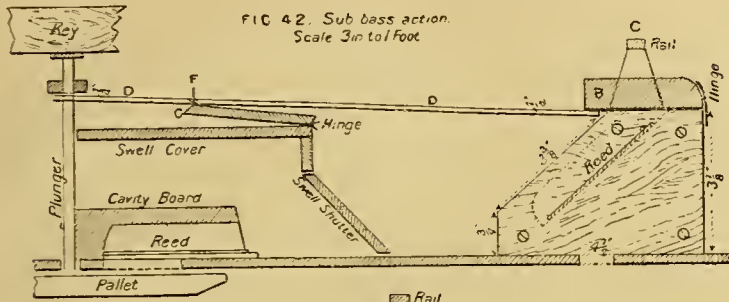


FIG 51 Exact size of Collar to fit Plunger

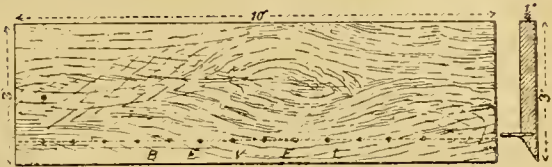
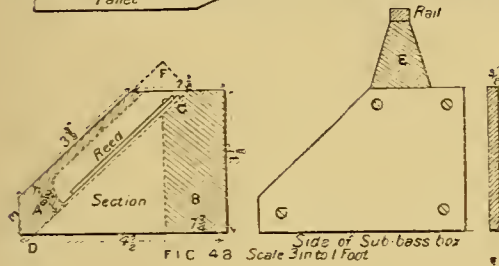


FIG 43 Sub bass action rail  
Scale 3 in to 1 foot

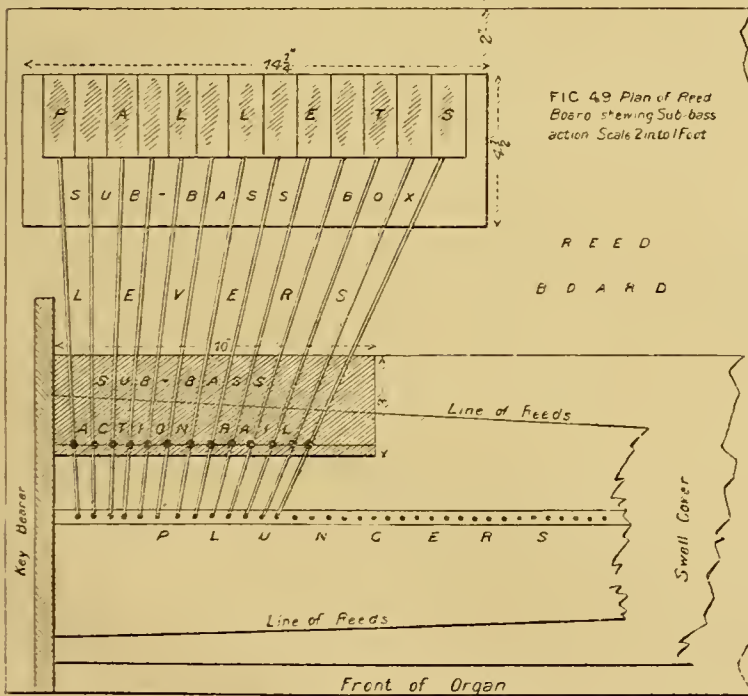


FIG 49 Plan of Reed Board showing Sub-bass action  
Scale 2 in to 1 foot



FIG 41 C.C. Sub-brass Reed.  
Actual size.

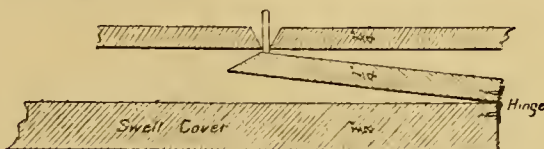


FIG 50 Details of Sub bass action rail

This action rail is to be placed upon the top of the swell cover at the bass end, close to the left-hand key bearer, but not so close as to impede its action, and with its *square* edge in a line with the back edge of the swell cover. The bevel of the action rail will thus be towards the plungers. Having found the correct position, hinge at the back, as shown in the illustration (Fig. 41), either with two small brass hinges, or leather, whichever is most convenient, to the top of swell cover (Fig. 50).

The levers next claim our attention. Any good seasoned wood would do for the purpose, but mahogany or walnut seem preferable, both on account of appearance and freedom from warping. They must be cut out of one piece of wood, of  $\frac{3}{8}$  inch stuff planed down to  $\frac{1}{4}$  inch. As you will see by referring to the illustration of the whole action (Fig. 49), the levers all differ in length; therefore, it would be best to cut them at first of one length, that of the longest one, which we shall find to be about 13 inches, afterwards cutting them down as required. The shortest lever should be  $11\frac{1}{4}$  inches. Every lever is to be made the same gauge throughout its length, *i.e.*,  $\frac{3}{8}$  inch broad, and  $\frac{1}{4}$  inch deep. A slot (A, Fig. 51)  $\frac{1}{8}$  of an inch long, and the same width as the plunger, must be cut at one end, from the top. The plunger fits into the slot, thus keeping the whole lever in position, otherwise it would often be inclined to wander away until out of touch with its collar. When all the levers have been so cut, place them side by side in the position they are to occupy in the action, one to each sub-bass pallet. Take especial care that each lever will lift its pallet in the middle. Now mark the place upon each lever, where the pin F (Fig. 41 and 43) is to be inserted, and with a very narrow chisel cut out the slot (B, Fig. 51,)  $\frac{3}{16}$  inch wide, and  $\frac{3}{8}$  long at the top, tapering down to a round hole of the same gauge as the pins to be used. The best pins for the purpose are the small pianoforte pins similar to those used for the fronts of the keys. They will be found to be just the size we require. Drive these pins through the slots made in levers into the action rail in a straight line  $\frac{1}{16}$  inch rear of the bevel. Between the action rail and the lever a thin wad of felt

must be inserted, to render the working as noiseless as possible.

The only thing now left for us to do, is to make thirteen wooden collars to fit over the plungers, to actuate the sub-bass levers when a key is pressed down. Fig. 51 illustrates the collar, drawn full size. The measurements must be exact, especially with regard to the depth of the collar, which must not exceed  $\frac{3}{4}$  of an inch, including the felt, as the same collar is used for the action of the octave coupler. They must be all turned in a lathe, so, if you do not possess that useful adjunct to an amateur's outfit, you must rely on the help of some friend, or failing this, a turner would do the job for a few pence. The collars will have to be felted on the underneath surface for silent action, and the hole through the centre should be of such a diameter as to fit tightly on to the plungers. Now I must describe the method of finding the exact position of the collar on the plunger. Lift up the sub-bass action rail, until the levers just clear the bottom rail of key frame by  $\frac{3}{8}$ , and by means of a small block placed underneath, keep the action rail in that position; also a weight must be placed for the time on the sub-bass pallets, to hold them down; then the collars may be slipped over the top of the plungers, and pressed down gradually until they touch the levers. This is the only method we have of adjusting the sub-bass action, so that this part of the work must be carefully done, although somewhat fidgeting. I may tell you that the set of levers on the action rail are moved bodily, in or out of action, by a cranked wire placed underneath; but more of this later on, when the whole question of stops is considered. I had hoped to have been able to proceed to the description of the octave coupler, but I find that it would be too long to include in the present chapter; therefore, next month we will consider that, together with the vox humana fan.

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EIKONOGEN DEVELOPER FOR SHORT EXPOSURES.  
—Distilled water 100 parts; sulphate of soda 40 parts. Dissolve and add crystallized eikonogen 10 parts; caustic potash 10 parts. For use dilute with 3 to 10 times its volume of water.

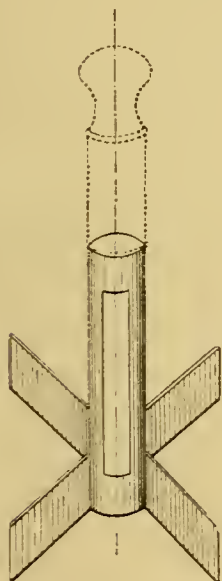
## A COMBINED APPLE CORER AND SLICER.

*By H. J. W.*

**S**UBMIT a device which may not be without culinary value during the fruit season. The enclosed sketch is a device that will core an apple, and leave it whole if desired, and will therefore be found useful for preparing apples for stewing, baking, and more especially for dumplings, or it will core

The cutters are hemmed or pleated on top, and are also butted to cylindrical tube. This should fit on corer like a telescope, and should not be too slack, and, on the other hand, should not be too tight. The handle of corer is an ordinary wooden one, and should be japanned black; as many cutters, or knives, can be used as thought proper, but four is generally considered sufficient, as shown in drawing.

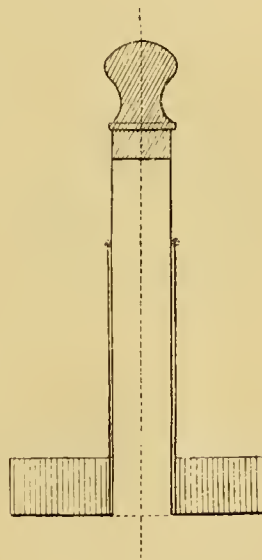
*Directions for using corer*:—Push the corer to the bottom of the seeds, turn the handle, which



ELEVATION OF CUTTER.



ELEVATION OF CORER.



SECTIONAL ELEVATION.

or quarter the fruit. Not only does it save a considerable amount of labour and time, but, after the dumpling is baked or boiled, you open it and find all the apple cooked evenly, which you do not with the old process, as when the apples are quartered they get mashed up, and when put in the paste are not companion pieces (very often), and perhaps are two or three pieces of different apples, which is not giving the cook or consumer satisfaction.

The drawing is half-size, and will, I think, carry out its intended purpose. A ring of No. 14 tinned wire (Birmingham wire gauge) is soldered around corer, so that when you are using cutter it will stop it coming too far up.

breaks the core loose, and leaves a bottom in the apple, withdraw the corer, and fill the space with sugar and spices to suit the taste; then cut the stem end of the core from the seeds, and put it on the sugar, as you would a cork in a bottle; bake in the usual way. The apple absorbs the sugar while baking, giving the fruit a delicious flavour.

BRONZE POWDER MAY BE MIXED INTO A PAINT by using japan dried with a small percentage of boiled linseed oil. Both should be fresh.

DARK ROOM.—One sheet of opal glass and two sheets of ruby give a practically safe light for the most sensitive plates.



## HOW TO MAKE AND USE AN ELECTROPHORUS.

By GREGORIE EDOUIN BEY.

**T**HE name of this simple instrument is a long one, and, perhaps, to some of our friends, an almost unpronounceable word. The instrument is said to be the invention of Volta, but I cannot just now say who gave it this name, nor why its inventor or sponsor chose such a name for such an unpretending little thing, although the word means "a bearer of electricity." It is easily pro-

battery of Leyden jars. Many young men may be found who take an interest in electrical experiments, but are unable, from want of enough skill and pocket money, to buy or to make a cylinder electric machine, or one of the new and splendid Wimshurst plate machines. To such, the electrophorus comes as a boon and a blessing, since it enables them to make a number of most interesting and amusing experiments at the cost of a small expenditure of skill and of money. When I take the instrument to pieces, you will see that it is only made up of a few bits of tin, glass, wood, and tinfoil, costing at the most only a few pence.

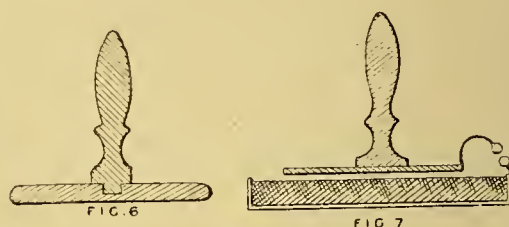
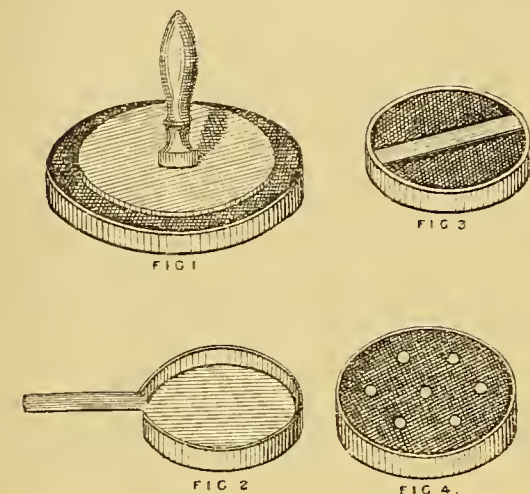


FIG. 1.—ELECTROPHORUS COMPLETE. FIG. 2.—EMPTY TRAY SHOWING HOW TO PLACE THE STRIP OF TINFOIL. FIG. 3.—TRAY FITTED, AND STRIP OF TINFOIL TURNED OVER THE CAKE. FIG. 4.—CAKE OF RESIN PLUGGED WITH PELLETS OF TINFOIL. FIG. 5.—HANDLE FOR METAL COVER. FIG. 6.—SECTION OF HANDLE AND WOODEN COVER. FIG. 7.—SECTION OF ELECTROPHORUS SHOWING HOW TO FIX CURVED WIRES AND KNOBS TO COVER AND TRAY.

nounced, however, when divided into syllables, as follows:—E-lec-troph-or-us; and it is as equally easy to make and work when you know how to do it. I therefore propose to take the little thing to pieces before your eyes, as I have done the word itself, and then let you see me put it together again, so that you may learn to make one for yourself.

What is this thing they call an electrophorus, and what is its use? It is simply an electrical machine, and one of the most simple; but, at the same time, like a very large number of common and simple things, it is a very useful machine. It is used for the same purpose as a Wimshurst electrical machine, and also the cylinder electric machines, to develop a charge of static electricity, and with it to charge a

By reference to Fig. 1 it will be seen that the electrophorus is made up of a round tin tray with raised edges, on which rests (as a cover) a disc of metal, having a pillar or handle standing up from the centre. The metal tray bears a close resemblance to the lid of a coffee canister. I am not sure but that such a lid could be used in making a small electrophorus. If the lid of a large tin can is procurable, it will make an excellent tray. If the reader does not possess a lid large enough, or anything out of which a tray can be improvised, he must make one, or get a tinsmith to make one for him. In this case the diameter of the tray should be from 9 to 12 inches, and be surrounded with a raised rim from  $\frac{1}{4}$  to  $\frac{1}{2}$  inch in depth. The material out of which the tray is made, may be thin

sheet zinc, tin, or brass. Those of my readers who studied the excellent lessons on tin-plate working in Vol. VII. of *AMATEUR WORK*, Old Series, will have little difficulty in making the tray for an electrophorus; so I shall not occupy space in giving directions for marking out the disc, cutting it out, and soldering a riband of metal around its edges to form a rim.

On examining the tray, it will be found to be filled to the brim with a substance very much like a cake of resin, or a cake of shoemaker's wax. It is neither of those substances, although resin enters into its composition. Resin, however, would be too brittle, and would break up under the flogging and rubbing it is likely to receive. We therefore melt together in an old iron pot, or in an earthenware pipkin, a mixture consisting of 8 parts of resin, 1 part of shellac, and 1 part of Venice turpentine or beeswax; and when these are all *well melted and mixed together*, run them into the tray. Some persons prefer a mixture of equal parts resin, shellac, and Venice turpentine. As, however, the efficiency of the instrument is largely influenced by the resin and shellac of the mixture, we should only use enough wax or Venice turpentine to make the resin into a firm, tough cake. The parts may be ounces or any other weights. It is best to thus give the proportional parts instead of a definite weight, as it enables the experimenter to make up a quantity to suit the size of his tray. It is also advisable to melt a little more than will be judged enough to fill the tray, so as to have it full to the brim, for a partly-filled tray would inconvenience the operator, whilst rubbing or flogging the cake. Before running the mixture into the tray, cut a strip of tinfoil half an inch in width, and long enough to stretch across the cake of resin; fix one end of this inside the rim of the tray, and let the rest of the strip hang outside, as shown at Fig. 2. On filling the tray with the hot mixture, this end of the strip will be pressed tightly against the inside of the rim, and be brought into close contact with the metal. Now, while the mixture is warm, turn the strip of tinfoil in over its surface, and smooth it down, so as to cause it to lie level across, and adhere closely to, the resinous mixture when cool, as

shown at Fig. 3. This device will obviate the necessity of touching the cover with the finger of the left hand before it is raised with the right hand, when drawing charges from the resinous cake. If this is forgotten, or it is wished to thus improve an already filled electrophorus tray, bore a few small holes through the resinous cake to the bottom of the tray, and plug the holes with little pellets or rolls of tinfoil, bringing their tops level with the surface of the cake, as shown at Fig. 4. By some persons this is deemed an improvement on a strip of foil across the cake.

The cover may be made of metal  $\frac{1}{16}$  inch in thickness, or of well-baked wood  $\frac{3}{8}$  to  $\frac{1}{2}$  inch thick, coated smoothly with tinfoil. It must have a diameter 1 inch or  $1\frac{1}{2}$  inches less than the diameter of the tray, and have a perfectly level and smooth under-surface. If made of wood, the wood selected should be of a kind not readily warped by heat and changes of temperature, such as teak or mahogany. The block or slab of wood, out of which the disc is to be made, should be first well baked to drive all moisture out of it, then worked whilst still very dry, and, as soon as it is finished, it should be soaked in melted paraffin wax, to fill all the pores, and prevent it from absorbing moisture from the air. All excess wax can be scraped off when cold, and the disc can then be polished with a pad slightly smeared with linseed oil. Whether the cover is made of wood or metal, it must be made perfectly smooth, its edges rounded and smoothed, and nicely polished, because all rough points and angles tend to dissipate the electric charge of the instrument.

The cover must now be furnished with a handle fixed to it at the centre on the upper side, so as to enable the operator to lift it on and off the tray. This handle must be a non-conductor of electricity, to perfectly insulate the hand of the operator from the cover. Handles made of glass have been recommended, and are in general use on shop-made instruments, but a handle of well baked and varnished wood is preferable to one made of glass, since this substance is apt to condense moisture on its surface, and this film of moisture acts as a conductor. The wood for the handle must be treated exactly



the same as that for the cover, namely, well baked before being worked into the form of a handle, then soaked in melted paraffin wax to fill the pores, then polished, and varnished with copal varnish. The form is shown at Fig. 1; 7 inches will be a convenient length, and  $1\frac{1}{4}$  inches diameter in the largest part be a convenient size for the hand.

If the handle is intended for a metal disc, the base should be curved out to a broad foot, as shown at Fig. 5, and this cemented to the centre of the disc with electric cement, or with any good holding cement, such as india-rubber cement, or marine glue, or gum mastic cement. If for a wood disc, the handle should be shaped as shown at Fig. 1, and then cemented into a hole in the centre of the disc, as shown in section at Fig. 6.

After the handle has been fixed to the cover, the wood disc may be coated with tinfoil. (No tinfoil will be needed for a metal cover.) To do this, get a piece of smooth tinfoil, large enough to cut out a disc of equal size to that of the wood, and with a little to spare over the edges. Coat the under surface of the wood with a thin but equal layer of rubber cement, or shellac cement; place the foil carefully on the wood, and press it down equally all over to get a smooth surface free from wrinkles and air bubbles; then set it aside to become firm. See to it that the edges are all turned up true and smooth, for ragged edges may cause failure in working the instrument.

We will now suppose it to be ready for work. What can we do with it, and how shall we work it? Make sure that it is free from dust and damp. Rub the surface of the resinous cake with a piece of soft warm flannel, or a piece of warm cloth, or flog it gently with a piece of cat-skin, hareskin, rabbitskin, or other piece of fur, or with the tail of a fox, or a similar furry tail, for a few minutes. Now place the cover on with the right hand, and touch it with the forefinger of the left. No effect will as yet be seen or felt. Lift the cover with the right hand, and present to it the knuckle of the left forefinger. If it has been properly charged, a spark will leap out from the edge of the cover to the knuckle of the finger. Replace the cover, and it will

receive another charge from the resinous cake, and this time without touching it with the left hand, if the surface is spanned with a strip of tinfoil, or studded with a few tinfoil plugs. We may thus go on for a long time, taking charges from the resinous cake and discharging them with the knuckles of the left hand, until the original charge has become exhausted. Then a little rubbing, or gentle flogging, will induce it to take up another charge, and this may be repeated as often as desired. If the electrophorus is resting on a highly polished table, it may not take the charge readily. In this case, hang a piece of clock chain from the rim of the instrument, and let this dangle on the floor to make connection with the earth, when it will receive a charge on being rubbed in the usual way.

Having satisfied ourselves that the instrument will work, let us try a few experiments.

1. Charge the electrophorus. Turn out the gas, and then try to light it by presenting the edge of the cover to the gas-burner after the gas has been turned on. A spark from the larger sizes will readily light a gas jet.

2. Present the edge of the cover to the knob of an electroscope. The leaves will be agitated, and show that an electric current has passed.

3. Take a Leyden jar and charge it with sparks from the cover of the electrophorus. This is done in this way. If unprovided with contact studs of tinfoil, or a contact strip of foil, the cover must be placed on the charged resinous cake with the right hand, then touched on the edge with the forefinger of the left hand, then raised and presented to the knob of the Leyden jar. A spark will pass from the cover into the jar, and by repeating the process the charge of the electrophorus may be transferred to the jar. If a large electrophorus, of from 15 to 18 inches in diameter, be employed, the sparks will be thick and long, and a good-sized jar may be soon charged; but the smaller ones will only do to charge small jars, and, in all cases, the process of putting on the cover and taking it off must be frequently repeated (perhaps from 80 to 100 times) until the jar is charged. With a charged Leyden jar a number of experiments may be made, some of which were mentioned in



my article on "How to Make an Electric Condenser or Leyden Jar," published in the May part of *AMATEUR WORK*.

I have described one of the most simple and inexpensive forms of this instrument; but it will admit of several variations in its construction. In some forms, two discs are employed as covers, or carriers, of the charge, one placed above the other, and connected by means of three or four short pieces of silk cord. Others have the di-electric, made of ebonite, or vulcanite, instead of resin. A shallow circular tray of metal has fitted into it a disc of ebonite, or vulcanite, and this forms the di-electric. The cover is made of metal, and is furnished with a glass handle cemented to the metal. I do not think, however, that any advantage can be obtained by this form, other than that of neatness in its construction and non-liability to crack. If a short piece of curved brass wire, ending in a metal knob, be soldered to the metal cover of an electrophorus, and a similar wire is soldered to the metal tray, the two knobs may be brought together when the cover is placed on the cake, as shown at Fig. 7, and thus the necessity of touching the cover with the left hand will be obviated. The curved wire with the metal knob will also be found useful in charging Leyden jars.

An electrophorus must be kept free from dust and damp, as both of these are injurious to the instrument. If charged, and then set aside protected from damp and dust, it will retain its charge for several days; but damp and dust form conductors to the charge, and convey it away into the air. If the handle is made of wood, it must be well varnished and the coat allowed to dry hard, and if this coat is injured in any way, it must be renewed. If made of glass, it will also be advisable to coat it with varnish to prevent condensation of moisture. A glass handle may be improvised out of a long phial bottle with the neck fitted and cemented into a disc of baked, paraffined, and varnished wood, and this cemented to the cover. Should the resinous cake crack, and so become useless, place the tray level on a hot stove, and remelt its contents, then draw aside on a level surface to cool and set firm.

## A TEA-TABLE WITH SELF-RAISING FLAPS.

By C. H. OZANNE.



SOME months ago, whilst going round the premises of a dealer in old oak furniture, we came to a triangular table with leaves which when raised made a circle. The proprietor, as he passed, with a gentle push caused the top of the table and the leaves hinged to it to revolve about the third of a circle. This act raised the leaves, and gave a circular three-legged table. Another gentle push, and the leaves fell into their original position. The table struck me as quaint, but I had not at the time the curiosity to examine into the construction of it. Lately, whilst ruminating on the subject of tables, it struck me that the idea might be adapted to a square table, and the present design was arrived at. I fancy the triangular leaf is somewhat of a novelty; at any rate, I have not seen a table with one.

The table in the sketch is 23 inches in height, suitable for afternoon tea. It is 18 inches square when the leaves are down, and  $25\frac{1}{2}$  inches square when they are expanded. This size was taken as a convenient one, and because it could be made of wood 9 inches wide, if anyone should make it of deal, ebonising or enamelling it as desired. More probably it would be made of some fancy wood, such as walnut, in which case the size could be regulated by the taste of the maker. An inner square of 20 inches would give an outer of  $28\frac{1}{4}$ , as will be seen if it is taken for granted that the side of the inner is to the side of outer square as 3 is to 4.24, a simple formula deduced from the 47th proposition of Euclid's First Book.

The most suitable size having been decided upon, four legs are turned  $22\frac{1}{2}$  inches long and  $1\frac{1}{2}$  inches in diameter. Into these legs are mortised the rails, as shown by the dotted lines in Fig. 2, marked A A, and by the dotted lines in Fig. 1, and in Fig 3 in section.

The lower shelf rests on blocks, a square piece being cut out of each corner of the shelf to enable it to fit close to the legs. The upper rail of this shelf is mortised into the legs, and the

little beads in Fig. 4 inserted in holes in shelf and rail. They can be put in in a vertical position, but the sloping position is suggested as less usual and less stiff.

The two rails, B B, in Fig. 2, are dropped into the rails A, so as to be flush with them. These rails are halved into each other, and at the point where they cross a hole is bored large enough to allow the shank of a screw bolt to fit tightly. In the top of the table is sunk a hole large enough to allow the rounded head of this bolt easy play. Over this hole is screwed an iron plate, which confines the head of the bolt in the hole in the table. This plate is shown in Fig 2, and the bolt in Fig. 1. When this bolt is held by the plate to the top of the table, and by the nut to the cross rails, the nut can be eased just enough to allow the top to revolve freely, but without any rattle; a little black-lead on the inside of the plate, where the shoulder

of the bolt works, would perhaps assist easy working.

Having got thus far, we have a four-legged table 18 inches square, the top of which revolves freely on the rails. To each side of this top is hinged a leaf, four of which put together, as in Fig. 5, would make a square of exactly the same size as the top, excepting, of course, the rounded edges. These flaps or leaves must be hinged to the edges of the top by hinges like that shown in Fig. 6, which is called a table hinge. It is exactly the same as the back-flap hinge, excepting that the knuckle is on the side opposite to the heads of the screws. This is necessary, so that the revolving top may have a smooth under-surface. The knuckle is let into the top and leaf, and the hinge screwed on so as to leave no projection.

Having fixed these hinges, the table is complete.

It is unnecessary to say

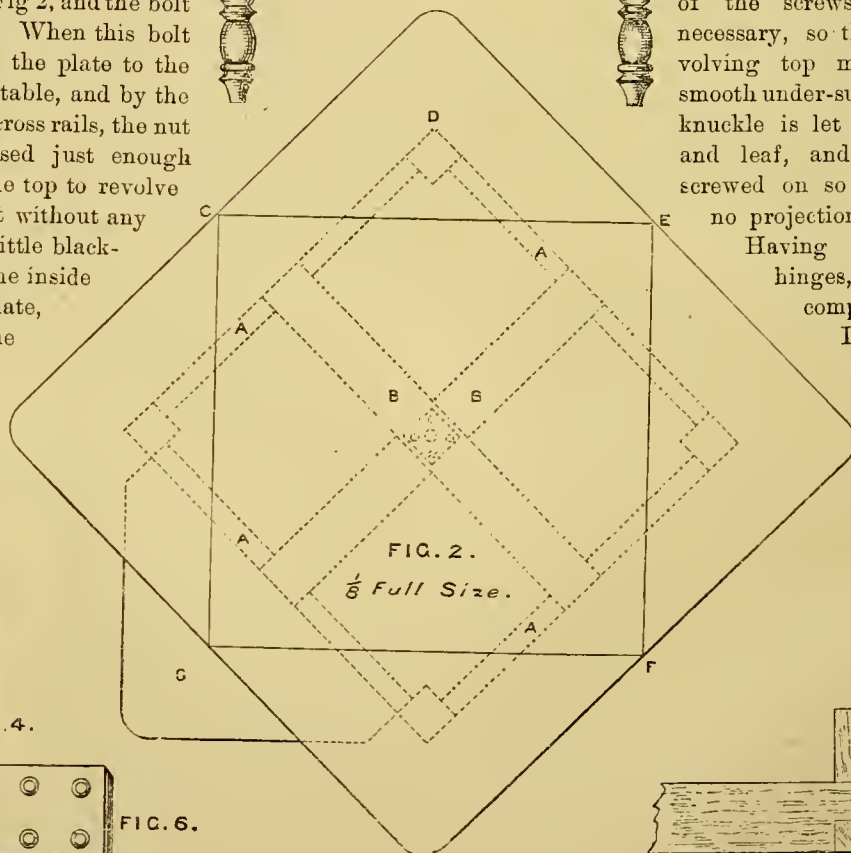
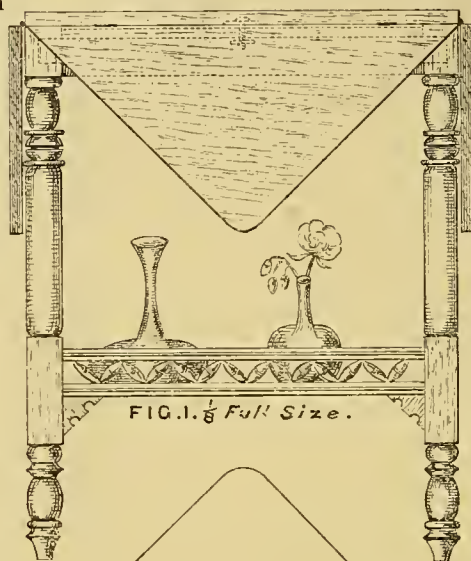


FIG. 4.



FIG. 6.

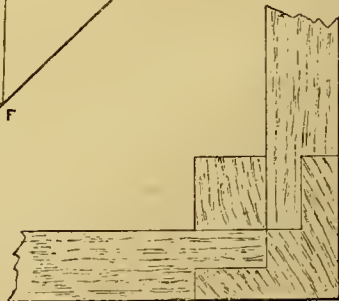


FIG. 3.

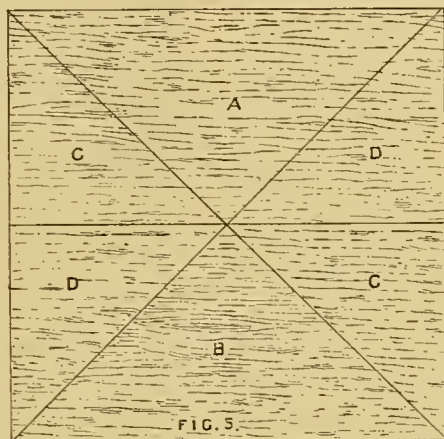
anything about finishing off the table; the back numbers of *AMATEUR WORK* go into that fully enough. Whether it is ebonised, enamelled, varnished, or finished in other ways, depends upon individual taste.

It is, I presume, clear to the reader that, in Fig. 2, when the point *c* reaches the point *D*, all the sides of the square top coincide with the square formed by the four legs joined by the rails *A*, and the flaps drop by their own weight. When the point *c* is made to travel on towards *E*, the flaps gradually rise until *c* reaches *E*, and the table is of its full size.

The top should be  $\frac{5}{8}$  inch thick, and the hinges should work easily, or the leaves will not fall at once, but hang about in awkward angles. Around the edges of the shelf a moulding can be cut, and a similar one along the upper rail. The edges of the leaves could be similarly ornamented if desired, but it does not seem necessary.

For anyone who has a fancy that way, the top could be made into a chess board. If there were another square drawn inside the 18-inch top, it would give a space about 13 inches square for the chess board, which is an ordinary size. The corners, *AA*, could be covered with a plain or ornamental veneer, say bird's-eye maple. The squares of the board could be built up of some dark and light veneer alternately. In this

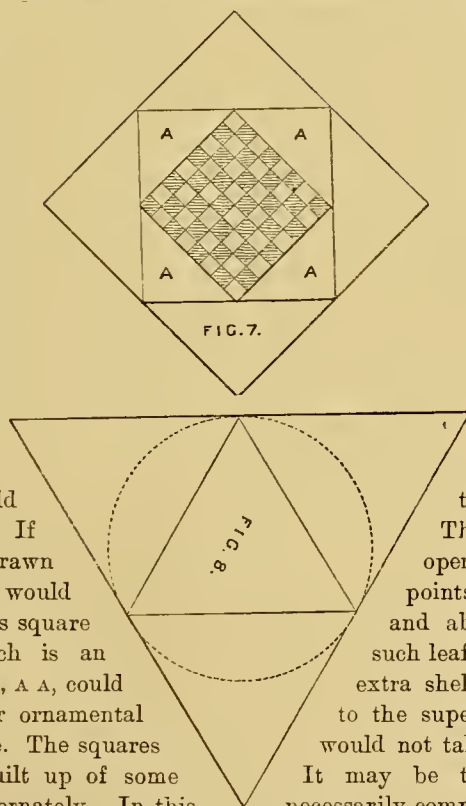
case the thickness of the flaps would have to be increased by the thickness of the veneer, so as to have a level table.



In Fig. 5 is a suggestion as to economy of material. The four flaps could be cut out of two pieces of 9-inch deal, each 18 inches long. *A* and *B* make a flap each; *c c*, joined, and *D D*, joined, make the two others. There is only the loss of the saw kerf, which could be allowed for.

Instead of the lower shelf, as drawn, a shelf could be made resting on blocks, and to this four flaps could be hinged like those forming the top, but with ordinary hinges. These flaps would fold in and upon the shelf, their points meeting in the centre, excepting for being rounded off. These flaps could be thrown open, and would rest upon rails running outside and parallel to the edges of the shelf, which would have to be cut back a little. The corners of the flaps would have to be taken off square to allow them to lie between the legs.

These flaps, when the table was open, would project from the points, *C E F G* (Fig. 2), of the top, and about 16 inches below. One such leaf is shown at *G* (Fig. 2). This extra shelf would be a great addition to the superficial area of the table, and would not take up much more floor space. It may be thought that it would unnecessarily complicate the table.



#### DESCRIPTION OF FIGURES.

FIG. 1.—PERSPECTIVE VIEW OF TABLE. FIG. 2.—PLAN OF TABLE OPEN; *G*, ONE LEAF OF SUGGESTED EXPANDING LOWER SHELF. FIG. 3.—SECTION OF LEG AND RAILS. FIG. 4.—TURNED PART OF RAILS SHOWN IN FIG. 1. FIG. 5.—MODE OF CUTTING OUT LEAVES. FIG. 6.—TABLE HINGE. FIG. 7.—EXPLANATORY DIAGRAM OF TABLE USED AS CHESS BOARD. FIG. 8.—DIAGRAM SHOWING TRIANGULAR TABLE WITH TRIANGULAR AND ALSO WITH ROUNDED LEAVES.



A similar table could be made on a framework forming an equilateral triangle, the leaves being rounded so as to form a circle, or so shaped so as to give a larger triangle. I made a small model on this circular plan, and I do not like it so well as the one drawn. I was, in making this model, puzzled for a few minutes as to how to lay on the rails, for it was too small to mortise them in. As each angle of an equilateral triangle is 60 deg., of course the rails should form this angle with each other. This is simple, but I spoilt a carefully prepared walnut table-top by forgetting it at the moment.

Perhaps it would not be out of place here to say that if the legs of a two-fold 2-foot rule are opened so that the inner points are 12 inches apart, the angle at the joint is 60 deg., as each leg is 12 inches long. Similarly, if the legs are separated 17 inches, the angle formed is a right angle. It is not mathematically correct, but it is practically so. This is proved by the 47th proposition again—about the only bit of Euclid that I have had occasion to apply practically. The legs of the rule opened  $9\frac{3}{4}$  inches give an angle of 45 deg. The proof of this is rather more abstruse. These three are angles that are frequently required, and the above are simple ways of finding them with the rule that is in the hands of every amateur carpenter.

On reference to Fig. 8 it will be seen that flaps of the shape of an equilateral triangle form, when raised, a table of the same shape. As each flap is of the same size as the central triangle, flaps of this shape give a table four times as large as the centre piece. In the square table the raising of the flaps only doubles the size.

If the flaps are rounded so as to form a circle, very little increase of size is secured, as shown by the dotted circle in Fig. 8.

RED OIL.—1 pint linseed oil;  $\frac{1}{4}$  lb. alkanet root. If mahogany be allowed to stand all night wiped over with this previous to filling-in, it will impart a deep rich colour; also useful for walnut and rosewood.

## THE WEIGHT OF FLY-WHEELS.

By ED. J. SMITH.

II.—FLY-WHEELS ACT AS RESERVOIRS OF ENERGY—WEIGHT OR VELOCITY?—THE BRITANNIA COMPANY'S FOOT-POWER SAW.



THE proper way to gauge gravity is to measure it by the velocity produced in a falling body at the end of one second; and the same holds good of any other constant accelerating force, due allowance being made for friction; thus, at the end of one second gravity has given to a weight of 1 lb. a velocity of 32 feet per second. In this case the accelerating force also equalled 1 lb. What is the force of inertia now stored up in the weight? Work done is generally measured in footpounds, that is, the energy necessary to lift a weight of 1 lb. a voidrupois to a height of 1 foot is called a foot-pound or an unit of energy; consequently, if a weight of 1 lb. be raised to a height of 16 feet,  $16 \times 1 = 16$  footpounds of energy will have been expended, and as energy is never lost, the 1 lb. weight will at the completion of its 16 feet fall be found to possess 16 units or footpounds of energy stored up in it in the form of inertia, the fall having given the weight a velocity of 32 feet per second. The friction of the air, being but slight, may be neglected; but in the case of a fly-wheel the friction will be more perceptible, therefore no matter whether the fly-wheel be heavy or light, the force of inertia stored up in it will always fall somewhat short of the force which overcame its inertia and friction and put it in motion, so that a heavy fly-wheel is no more powerful than a light one, since either only acts as a reservoir or accumulator for energy which, stored in the form of inertia, it is ready to give out in large or small quantities as the irregularity of the supply or demand of the machine may determine. Thus, in turning a piece of iron in the self-acting lathe, the demand of the machine is for one constant supply of energy; but if this lathe is driven by foot power, the supply is anything but constant, the foot only being able to exert any useful effect when the treadle is

descending, and probably little or no energy is used during either the first or last quarter of such descent, so that only during  $\frac{1}{4}$  of a revolution does the fly-wheel receive a propelling force from the foot, and that is constantly varying, being most when the crank is horizontal; but through the facility the fly-wheel offers for storing energy, not only is it carried through the remaining  $\frac{3}{4}$  of a revolution without any further aid from the foot, but the work continues to revolve without any very perceptible variation in the velocity.

Amongst the many examples of the adoption of the fly-wheel for storing energy, the engines used for driving our iron rolling mills command attention, the mills being alternately called upon to perform very heavy work, to be succeeded by a period of rest, and in this instance 40 tons is no uncommon weight for the fly-wheels of their engines.

As before mentioned, a 1 lb. weight in falling 16 feet acquires 16 footpounds of energy, but a weight of 2 lbs. falling through 8 feet would acquire  $8 \times 2 = 16$  footpounds of energy; likewise a weight of 4 lbs. falling 4 feet would acquire  $4 \times 4 = 16$  footpounds, or 8 lbs. falling 2 feet  $= 8 \times 2 = 16$ , the same energy, the velocity acquired being 32, 16, 8, and 4 feet respectively. Thus we see that the heavier the body the less the velocity necessary to store up *equal* amounts of inertia; if, however, the above weights of 1, 2, 4, and 8 lbs. each moved over equal spaces of 16 feet in 1 second the energy expressed in footpounds stored up in each respectively would be 16, 32, 64, and 128; but since it, as before mentioned, is impossible to create energy, the bodies will, in the same proportion as they increase in weight, require a like increase of energy to be imparted to them in order to attain equal velocities. But often it is found more convenient to make use of the converse of this, *i.e.*, to reduce the weight of the body or fly-wheel, and increase its velocity. An example of this is to be seen in the modern development of the treadle sewing machine. Whereas formerly the driving wheel connected with the treadle was formed as a heavy fly-wheel, now it is made very light, and the energy necessary for the machine is stored up in a wheel about one-

third its diameter, but revolving at five or six times its speed; and a still more remarkable instance is found in the treadle circular saw bench of the Britannia Company, of Colchester, issued by them with three saws and a pair of bevel washers for grooving, at £15, and to which can be fitted scroll-cutting, grooving, boring, dowelling, mitre-cutting and dovetailing attachments, and with which ripping, squaring-up, cross-cutting, shouldering, rabbeting, tonguing can be done, particulars of which I am able to give you through the courtesy which has become as well known as the excellence of the productions of this eminent Company. The machine, which is strongly and yet elegantly made, is driven by foot power. The driving axle having an external crank at either end, the treadle, therefore, is particularly firm to the tread; and on the driving axle is mounted a large cog-wheel which, engaging with two pinions, drives two other axles, the upper one of which carries the circular saw, and revolves  $13\frac{1}{2}$  times to once of the driving axle; whilst the lower one, carrying a fly-wheel of about 28 lbs. weight, revolves  $7\frac{1}{4}$  times to once of the driving axle. Now the fly-wheel of my own lathe, a 5in. screw-cutting one, weighs about 112 lbs., and the rate of treading averages about 100 per minute; but if this circular saw is trod at the same rate, we should get not 100 but 725 revolutions of the fly-wheel, which, however, is but  $\frac{1}{4}$  the weight of the former. But we have already shown that a weight of 1 lb. possesses 16 footpounds of energy when it has acquired a velocity of 32 feet per second, which it would acquire by falling 16 feet, and that a 4 lb. weight possesses the same amount of energy when its velocity is 8 feet per second; therefore the 28 lb. fly-wheel would possess the same amount of inertia as the 112 lb. fly-wheel if it only revolved at 4 times the velocity of the latter, but it actually revolves nearly 8 times as quickly, and so, though but one-fourth of its weight, it would, at equal rates of treading, store up nearly double the amount of energy; and the amount of work that this stored up energy is capable of doing is to cut 4 feet of 1-in. pine after the foot has been taken off the treadle. If after 8 good treads the treadle be stood upon, there is sufficient energy to carry

one bodily up and down 24 times before bringing the machine to rest. The usual rates of treading this saw are from 60 to 70 per minute, the saw revolving about 800 times per minute.

With regard to fly-wheels, one other point must not be forgotten, viz., in a fly-wheel having a rim, weighing, say, 50 lbs., regard must be had as to at what distance that rim is from the centre of the wheel when the rate of motion is expressed in revolutions per minute or second, as, if the radius is doubled, the velocity is also doubled, and consequently twice as much energy required to impart that velocity or stop it, leaving out the question of friction; thus, in wood-turner's lathes the fly-wheel is oftentimes built of wood, but to gain speed and inertia is frequently even as much as from 3 to 4 feet in diameter.

## A WATCH-STAND FOR FRETWORKERS.

By ED. C. ROE, Jun.



WATCHMAKER will tell us, and I do not suppose that anyone will dispute his opinion, that it is far better for a watch to be kept as much as possible in a

similar position to that in which it is carried; that is, in a vertical position, or nearly so. With the idea of providing an article of general utility, as well as ornament, I have sketched, and shall describe, as far as possible, the way in which the watch-stand should be made so as to obtain the best results.

The stand, as a whole, calls forth very neat, patient, and careful work, and, therefore, care and



precision must be the order of the day.

I shall adhere to my usual custom, and discuss for a few moments, or rather deal with, in a few lines, the material which may be used, and which will give the most advantageous results. The following arrangement will be found very effective:—Olive wood for the following parts: legs, bottom of under-tray, frets in watch panel and front ledge; the remainder to be executed in rosewood.

Should rosewood be deemed by any worker too brittle, the stand would look exceedingly well executed entirely in olive wood.

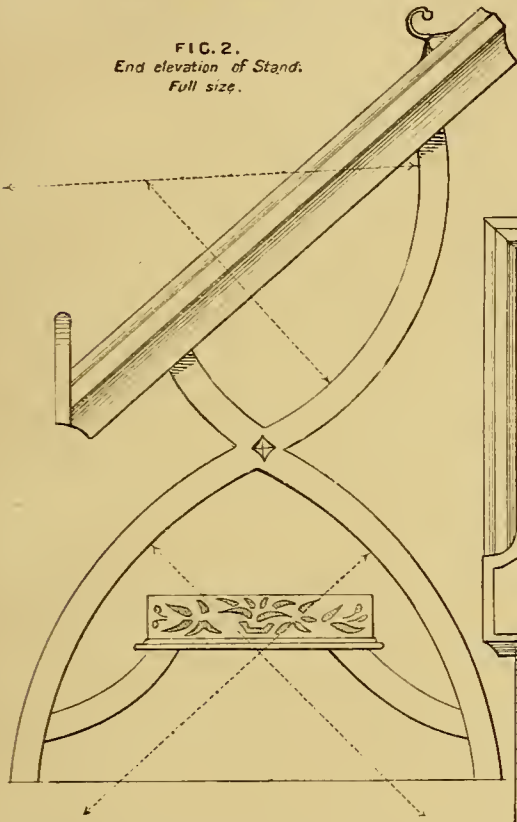
The sketches are full size, and may be pricked off direct on to the stuff. This being the case, I shall abstain from giving any actual measurements whenever such can be taken off sketches. The watch panel, it will be seen by reference to Fig. 1, is constructed by taking a piece of  $\frac{1}{8}$  stuff to form the back, and upon this is fixed the fret which forms the recess for the watch to lay, or

**HOLES IN GLASS.**—The simplest and safest way to bore holes in glass is to use a copper or brass tube, quite thin, of the size of the hole. Bore a hole in a small block of wood about  $\frac{1}{4}$  inch thick. Hole to fit the tube loosely. Fasten the block to the glass with beeswax, so that the hole corresponds with the required hole in the glass. Insert the tube in the hole, and pour emery (No. 90) and water into the tube with a spoon, and turn the tube back and forth with the fingers, or a little grooved pulley may be put on the tube to work with a string, in which case a centre should be placed at upper end to guide the tube. In this way a hole of any size from  $\frac{1}{8}$  inch to an inch or more may be cut through ordinary window glass in a few minutes.



rather hang in. Round three sides of this is mitred a small moulding, section as at Fig. 1,

FIG. 2.  
End elevation of Stand.  
Full size.



the front edge being bevelled, as shown at Fig. 2, for the purpose of receiving the front ledge fret, which is formed by a back piece of  $\frac{1}{8}$ -inch stuff, the fret being cut to the inner line out of similar stuff, and glued on. Be careful the glue does not exude between the pattern. Respecting the hook on which to hang the watch, very many beautiful varieties are supplied by the various fretwork material dealers advertising in this magazine. The bottom of watch sinking should have a piece of plush or velvet let in, and glued or pasted down.

The supports, or legs, will require very careful cleaning up after cutting out, the great thing being to keep the arrises sharp. The best method of fixing to top will be to use a small screw, putting in from top side of watch panel previous to fastening on fret.

The under-tray will require careful work, being rather small; but if care and good glue be used, no insurmountable difficulty should present itself. The four supports are best fitted to and then fixed to legs, by means of a small dowel. The same method may be used with advantage when fixing to bottom of tray.

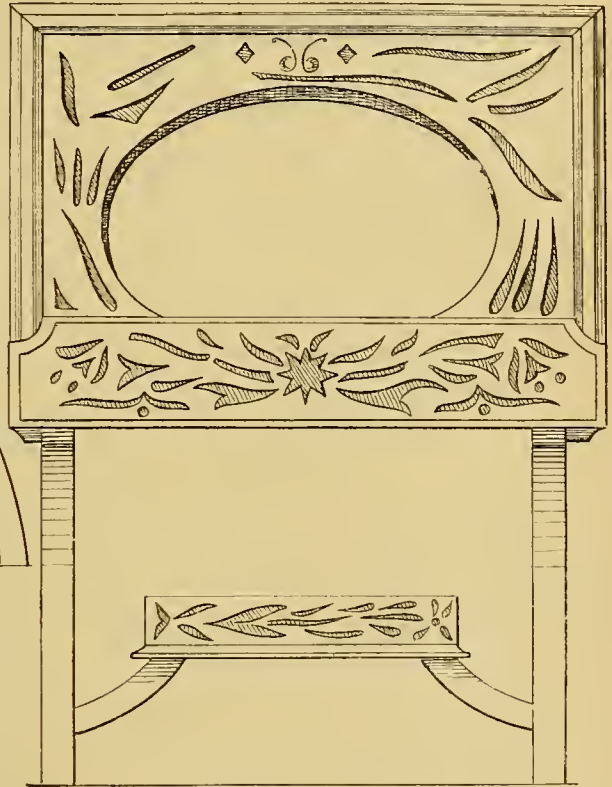


FIG. 3. Front view of Stand.

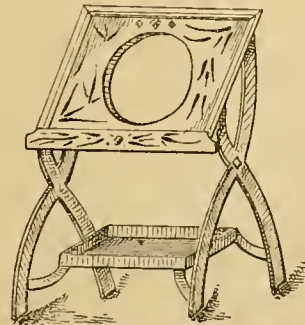


FIG. 1.  
Sketch of Watchstand complete.

The stand being completed, the final touch remains to be given, without which our work will look comparatively dull, namely, polishing. This requires to be done in a very thorough manner, and unless the worker is well-up in French polishing, it will be advisable if assistance be obtained at this stage of the proceedings. Half the charm of these fancy things, I think, lies in the finishing process. Not that I mean to advocate polishing a thing to death, to hide defective workmanship, but when work is properly executed and polished, the polish enhances the beauties of finish, and consequently brings credit to the maker. However, I must perforce leave the settling of this question in the reader's hands, trusting pleasure, as well as profit, will be derived from the perusal of this short paper.

## THE MYSTERY OF STATIONERY FORWARDING.

### ACCOUNT-BOOK BINDING.

By ALFRED BEAN.

#### III.—ROUNDING THE BACKS—PRESSING—CUTTING AND MARBLING THE ENDS—FINISHING THE BACK.

O return now, after the last slightly digressive chapter on marbling, to the binding of our ledger. This you will remember we left with the back "glued up," the edge being cut and either marbled or otherwise decorated. The next proceeding is to form the back of the book into a round, to effect which it must be smartly hammered. First get the back of the book as nearly as possible level with one of the sides, by pressing down the angle formed by that side and the back; then beat away until it will keep that shape of itself. The book may then be turned over, the same process being gone through on that turned-up side. Now pull the back into as circular a shape as possible with the fingers, afterwards beating each side of the book alternately until sufficient curve is secured, which curve you must take care to have quite even and geometrical the whole length of the book. A heavy castigation should then be given at the angle on each side, to fix, as it were, the original form. Throughout the

whole of this rounding process, moreover, you must remember to keep the hammer moving about the back; never hit twice in the same place.

After this chastisement the volume should be opened at the junction of each end-paper with the body of the book, in order to attach those supplemental leaves more firmly, by glueing their entire surfaces, to the first and last page, respectively, of the interior. Should the ledger possess an index, this also must be secured in the same manner. You will, of course, take care to have the glue and brush perfectly clean, unless, indeed, you wish to make a kind of obstacle race of your penmanship; each hair and bit of dirt in the glue, let me tell you, will be much more visible when separated by a leaf or two of the book in which it has been pressed. Before, however, giving it this necessary pressure (which should be continued for a space of at least two hours—more, if possible), the outstanding slips should be bent away from the book; a perfectly smooth board being also placed at each side. In putting in the press, too, see whether the round of the book is displaced, as if so, it must now be set right.

After its removal from the press, the cutting machine must again be brought into use; on this occasion for the purpose of smoothing the head and tail of the book. If for these cuts the plough is employed, you must be, if possible, more careful even than when using this tool for the fore-edge, or, in addition to the results I have already been compelled to anticipate, you may perhaps succeed in removing from the ledger small pieces out of the back or fore-edge, which two portions of the book, you will observe, cannot receive any pressure.

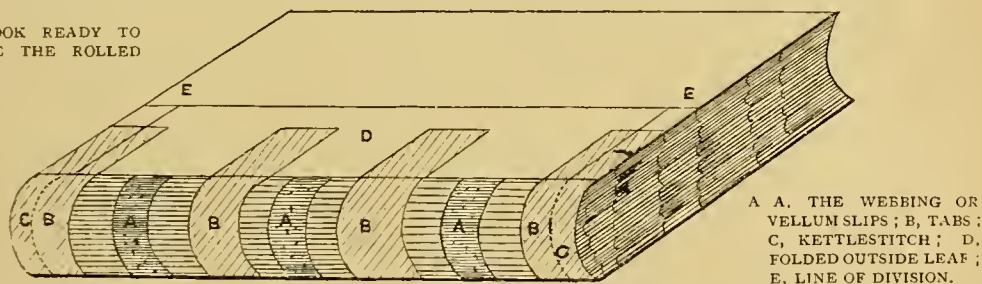
The marbling, which, of course, must follow the cutting, will need, I hope, no further comment, save that the pattern must be the same as the one followed in designing the first edge. After both ends, then, are satisfactorily marbled, and the colour has become dry, cut two strips of millboard a couple of inches shorter than the book, and an inch and a-half wide. The weight of the board from which these strips should be cut will vary, of course, with the size of the book for which they are intended: a foolscap,

for instance, having a thickness of a couple of inches, will require the No. 1 board; whilst for a demy, say of four or five inches, a No. 3 would be substituted.

These strips must be affixed, one on each outside leaf of the book, with the edge at about an eighth of an inch from the angle of the back. When this has been done, glue over the entire surface of the leaf, including the strip, and pull tightly over the latter the ends of the slips on which the book has been sewn, afterwards glueing these pieces also. Now fold down about a fourth of the leaf, and bring the crease so formed to just inside the back edge, the whole being rubbed thoroughly down with the folder. A sufficient number of strips of leather should then be cut to fill up the spaces between and on the outside

eighth part less than the thickness of the book. Along this roller glue the edge of a piece of stout wrapping paper of the same length, and wide enough to permit of being rolled around it about a dozen times. Now cut a piece of millboard an inch longer, and from three to five eighths of an inch wider than the back, measured round the largest portion, which will be at the leather-covered kettlestitch at either end. The thickness of the piece must be again governed by the size of your book, a one inch foolscap being generally provided with a No. 1, a three inch with, say, a No. 3 board. For heavier and larger books two boards should be cut to equal size and glued together, as a thicker board than the No. 3 would most probably break during the after process of rolling. Get

FIG. 6.—BOOK READY TO RECEIVE THE ROLLED BACK.



of the slips; a book, for example, sewn on three of these latter, will require four strips of hide. It matters not what kind of leather is used for these "tabs," provided it is of good quality and sufficiently mobile, as the pieces are entirely hidden from sight when the book is completed. They should be firmly glued in each space on the back, the ends being allowed to lay on the sides to a distance of about two inches from the angle. Great care must be taken to make these tabs adhere firmly, as they form, indeed, the main support to the interior working of the book. The back itself should be thoroughly glued, as well as the strips; the tools usually used by the binder in rubbing down these being his own fingers, moistened with paste, or perhaps something even more convenient.

Before being put aside to dry, the back must be once more examined, to be, if required, put into correct form, after which, obtain an ordinary wooden roller of a diameter about an

now some of the very thickest brown paper procurable, and cut from it a piece the length of the above board, but measuring five times its width. This piece must then, after being thoroughly glued, be wrapped tightly around the board or boards just cut.

The roller may then be placed in front of you, on a solid table or bench, the wrapper being unrolled to the farther side of the cylinder. Take this covered board, and, after passing through and through the flame of a gas-jet until quite soft, place it on the outspread wrapper with one of the long edges close up to where the cover is attached to the roller. This cylinder must then be rolled over the underlying board; in doing which your whole strength must be utilised in order to force this outside back into as perfect a shape as possible. Moreover, if, whilst rolling, you feel any inclination on the part of the board to crack or become angular, you must at once desist, take it out of



the wrapper, and reheat. If this does not suffice, choose a thinner board, and cover with an additional turn or two of paper to make up the thickness. After wrapping about the roller the whole width of the paper, give it a thorough good rolling under an oblong board, measuring, say, 18 inches by 6 inches. To do this effectively you should stand with your right side to the bench, the board being extended under the right forearm, whilst the top end is gripped by the same hand. The roller should be held loosely by the left hand, under the board, and at right angles to the edge of the table. After the back has been sufficiently rolled, you may return again to the ledger, dividing now the two folded outside sheets with the shears into three portions, by making a cut parallel to, and at an inch from, each top and bottom edge; this cut should just about divide the overstepping part of the end tabs in half. You had better also cut away about an eighth of an inch at the edges, to prevent any possibility of the tab projecting over the end leaf, when the latter is finally glued down. Whilst using the shears, too, just notice whether the marble paper on either end leaf shows at all at the fore-edge of the book; if so, such portion should of course be trimmed off.

Sufficient time having been allowed to elapse for a proper hardening—three hours should be about the time required—the rolled back may be taken from its mould to receive preparation for affixture to the ledger. To make the fit as perfect as possible, the long edges of the back will require to be slightly bent over, in order that they may grip firmly the sides of the volume; to accomplish this object, a strong straightedge must be secured in a convenient position in the press, from which a portion the length of the back should be allowed to protrude. Now place each edge in turn of the back slightly over this straightedge, and run along it the folding-stick until the edge is sufficiently depressed; if the back is too heavy to receive any impression from the folder, you must, perforce, obtain your object by means of the hammer—of course, used gently. You must take care, however, in both cases that the paper composing the back is not rubbed away, or a rough surface created; you

will find it the better plan, I think, to rub the folder and hammer over with a very little grease before using. It is as well not to make too sharp an angle in bending this back; round it off, in fact, as much as possible. I may also say that, instead of using the straightedge for the above purpose, you might, perhaps, be able to find something more solid which could be used with advantage; where machines of any kind are employed, there is nearly always, I think, some portion which will serve that end. In a bindery the guide of the board-cutting machine is often made available; anything, indeed, possessing a straight edge, and having enough projection to allow of even half the length of the back being placed thereon, will suffice; on the completion of one half the back may easily be turned round to permit of the other being manipulated.

Now cut two pieces of cloth—any waste bits will do—the length of the book, and about 2 inches wider than half the width of the back, to the interior of which they must then be glued, their edges being made to meet along its centre. By the aid of the 2 inches of overhanging cloth on each side, which must be glued to the central division of each folded and tabbed outside leaf, we shall now be enabled to fix the back finally in position, care being, however, taken, by means of measuring each side at top and bottom with the compasses, to have it quite square, and at the same distance from the fore-edge on both sides; the ends also must project to about the same distance from both head and tail of the book.

Now a little more genuine work with the plough—that is, of course, supposing you cannot boast a proper machine in cutting the boards. You may, indeed, save yourself this labour by taking them to the nearest forwarding shop for reduction; but I think that, as a rule, the amateur, not being like some of his professional brethren, a little afraid of extra exertion, will prefer cutting the boards himself. Should, however, anyone decide to employ the binder, time and trouble may be economised by giving the exact size of the boards required at once; the workman will see that they are properly squared.

Supposing you do the work yourself, you must first take a small trimming—just enough

to make smooth and straight—from off the split edge of the boards, then cut one of the shorter edges at a right angle to it. When this has been done, place one of them on the underside of the book, with the split edge quite close to the rolled back, the other trimmed edge being put at from  $\frac{3}{8}$  to  $\frac{1}{4}$  of an inch from the head or tail of the book, according to the size, remembering in this that the account-book board is always given a much larger square than that surrounding the letterpress volume. When you have marked the board close to the remaining two edges of the ledger, it should be placed in a similar manner on the other side, in order to see if the two edges there coincide with the marks first made, as, of course, they should do if the back has been properly placed, and the book carefully cut. If this is not so, each board must, perforce, be marked to fit its own side, the two being, of course, distinguished in some manner in order that they may be returned to their original sides when cut. After cutting through the marks, open the divided portion of the boards as much as is possible without breakage, and cover the interior on both sides with a coat of glue, which must moreover be thoroughly brushed into the material. In then placing them in position on the book, put the central division only—including, however, the whole length of cloth—of the folded and stiffened leaf in the glued crevice in the board, the thinnest constituent of which should lie nearest the leaves. They should be placed with an equal margin or square at head and tail, the square at the fore-edge being made by the general rule slightly wider than that on the ends; this should leave the width of groove between the back and the edge of the board of just about the correct amount to ensure the proper opening of the ledger. The outer divisions of the leaf should be kept next the book, in which position they will cause a closer union of the boards when the volume is put under the pressure which should be now once more its destiny.

On taking it out, after a couple of hours or so, of this very important process, the book must have its back covering reduced to a proper length, viz., that of the boards. A fine-toothed saw is the best tool to use in executing this

amputation; if kept even with the edge of the board it should cut the back with the exact square required, though, provided the fault is on the outside of the proper cutting line, any accidental irregularity may be easily corrected with the shears or knife. When you have got thus far the book will be ready to receive its suit, the material and style of which will form the subject for consideration at our next meeting.

## SASH MAKING.

By FAUST.

IV.—HUNG SASHES (*continued*).



OUR case is now finished, and you are ready to begin on your sashes; but before doing so, some modifications of the case described may be noted. In London, where most of the houses are of brick, and thinly built, a different form of case is used, that is, so far as the construction of the sides are concerned. The form of this case is shown in section in Fig. 21, which will be self-explanatory. Of course the shape of the sole and lintel remains unaltered, and is the same as already described. In London, also, the term "facing" is not applied to the side pieces on the stile, but they are called the outside and inside "linings." In many places the back lining shown in Fig. 21 is omitted, as is also the middle division between the weights. This is a matter of little consequence, however, as these pieces do not tend much to the preservation of the frame, and but take up part of the room that is required for the free play of the weights. I have seen in some country places window-frames with a sole like Fig. 22—the sash simply rested on the bevel of the sole, and there was nothing in the way of a check to prevent the weather from entering the house; this form of sole might do for outhouses, but I certainly thought it a very bad form for a dwelling. A good deal depends, however, on individual requirements, and the framings described can be varied to suit.

We come now to the sashes, and the mode of getting the sizes for them. We will begin with the length. Take a rod of wood, say about



$\frac{5}{8}$  inch square, lay it against the side of the case, one end close up to the underside of the lintel; then mark it carefully at that part of the sole marked *A* in Fig. 15; lay the rod on the bench, at the bottom end mark off  $3\frac{1}{2}$  inches, that is, the width of the sole of the under sash; at the top end mark off  $2\frac{1}{2}$  inches, the width of the lintel of the upper sash; square these marks across. Sometimes the top and bottom sashes are made the same size, but a window generally presents a more pleasing appearance to the eye when the top sash is smaller than the bottom. In most places the rule for this is to divide the length of the case into seven equal parts, giving four to the lower, and three to the upper sash. We will make our window in this way; so divide your rod into seven parts, at the fourth part from the bottom square it across, and then make another mark across it  $1\frac{1}{2}$  inches lower down. This gives the position of the "chess," or "countercheck," as it is commonly called, of the window. Now lay off on the rod the mortises for the sole and lintel, divide the countercheck into two equal parts, giving  $\frac{3}{4}$  inch in each. Fig. 23 shows the rod with these marks on it. In the window shown there are two upright sash bars or "mullions," but if you desire to have smaller panes, you must mark off the position of the transverse bars upon this rod, in the same way as described in setting out the sash in the former paper. This, however, is only a matter of detail. Set out the sash stiles with this rod, making the mortise to receive the tenon of the countercheck in the *lower* sash only  $\frac{3}{4}$  inch long—that is, half the thickness of the countercheck; but in the top sash make the mortise the full  $1\frac{1}{2}$  inches, and see that you leave a "stump" under it at least 3 inches long. The reason for this will presently appear. Make another rod the width of the case, set out on it the width of the stiles and the mortise of upright bar (see previous paper for mode of doing this); mark off, and square all the tenons and mortises. We will now turn to the counterchecks, which are a little intricate to the novice, and will demand his closest attention. The two pieces of wood used should be  $2\frac{3}{4}$  inches wide, and  $1\frac{1}{2}$  inch thick. Take your width rod and mark off the shoulders of the tenons, square

them across, and tenon as shown in Fig. 24, *A* showing the top, or outside sash, and *B* the lower, or inside. Remove the piece between the tenons with a  $\frac{1}{2}$ -inch chisel, cut off half of the tenons from the upper sides of the lower one, so as to leave it  $\frac{3}{4}$  inch wide; this lower countercheck must be grooved, *not checked*, for the reception of the glass; the top one being checked in the ordinary way. To get the proper positions for the tenons, after running your mortise gauge (which must be set as shown in last paper), set a marking gauge to  $\frac{1}{2}$  inch further from the edge than the outside of the mortise; run your gauges on the top countercheck from the outside edge, and on the lower one from the inside edge. Figs. 25 and 26 are sections showing the position of tenons. Of course you will understand that the mortise for the top countercheck must be ganged off the *outside* of the stile. After mortising, cut a piece out of the stile where the outer tenon of the countercheck passes through, using the same marking gauge as you did for the tenons, as you will see shown in Fig. 27; this groove gives steadiness to the framing, and tends to prevent warping.

You were told to leave a "stump" on the top sash stiles about 3 inches long. This was for the purpose of working a moulding on, which must now be done; that is, if you wish your work to look well. In good work the upper "stumps" of the lower sash are sometimes moulded also. The advantage of this is that it gives the full width of the countercheck as a tenon, and so adds to the strength; but this is not usually done. Take a small piece of thin wood, and make a mould of whichever shaped moulding suits your particular fancy; place your upper stiles together (after running your glass checks and mouldings), cramp them in position with a sash cramp, lay your mould against them, draw it on the outside stiles, and then work out your moulding on the stumps; this mode secures uniformity. A chisel and gouge may be used for the work, but the usual way is to do them with hollow and round casement planes. When you are making more than one window, and can get a number of stiles cramped up together, this is the best and quickest way, but



a chisel and gouge will do very well for a single window. Your stumps finished, and all your mitreing done, the sashes may be cramped up and finished off, as before described, and are then ready to fit into the case.

The fitting of sashes into cases demands great

We will not follow his example, but do our work well, and then we shall have no cause to fear the rains and draughts of the winter. Set the case upright against the wall of your workshop, the inside facing you, nail a slip of wood diagonally across it on the *outside*, having pre-

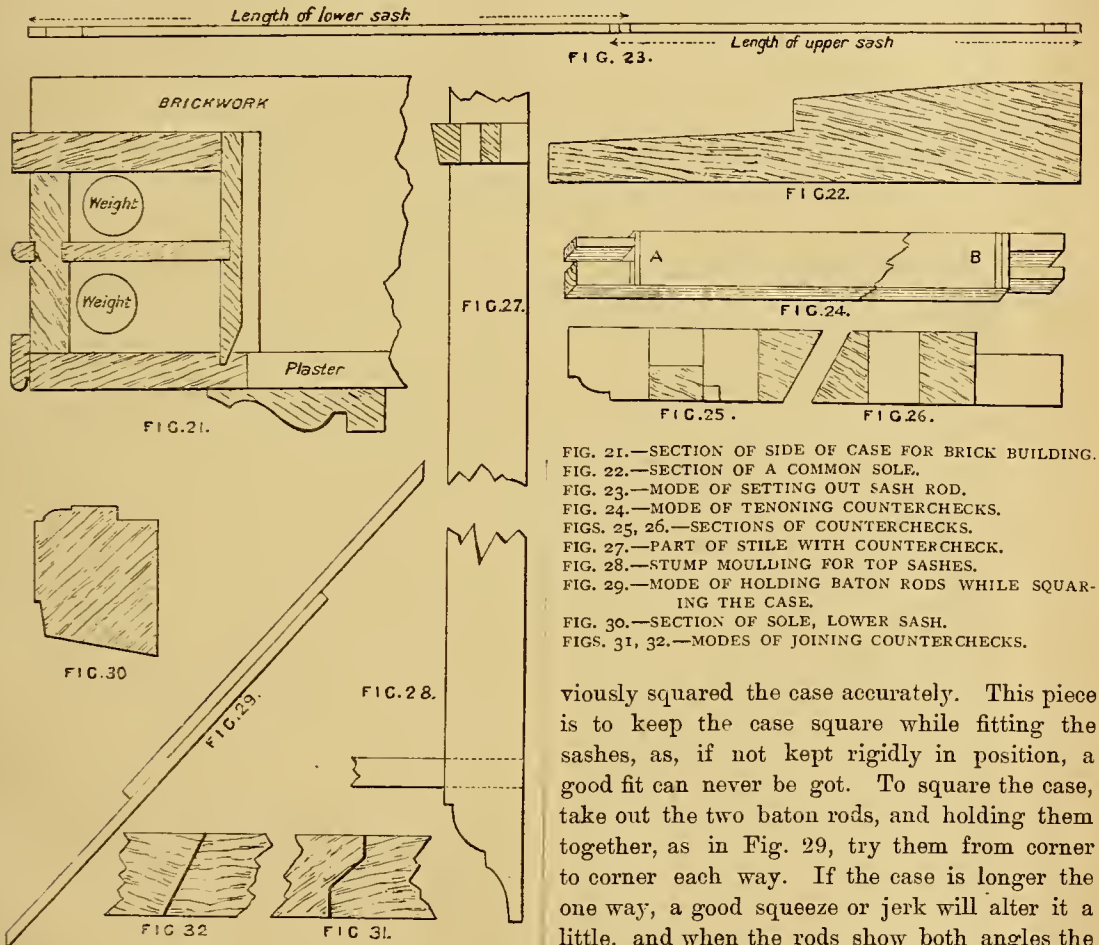


FIG. 21.—SECTION OF SIDE OF CASE FOR BRICK BUILDING.  
FIG. 22.—SECTION OF A COMMON SOLE.  
FIG. 23.—MODE OF SETTING OUT SASH ROD.  
FIG. 24.—MODE OF TENONING COUNTERCHECKS.  
FIGS. 25, 26.—SECTIONS OF COUNTERCHECKS.  
FIG. 27.—PART OF STILE WITH COUNTERCHECK.  
FIG. 28.—STUMP MOULDING FOR TOP SASHES.  
FIG. 29.—MODE OF HOLDING BATON RODS WHILE SQUARING THE CASE.  
FIG. 30.—SECTION OF SOLE, LOWER SASH.  
FIGS. 31, 32.—MODES OF JOINING COUNTERCHECKS.

viously squared the case accurately. This piece is to keep the case square while fitting the sashes, as, if not kept rigidly in position, a good fit can never be got. To square the case, take out the two baton rods, and holding them together, as in Fig. 29, try them from corner to corner each way. If the case is longer the one way, a good squeeze or jerk will alter it a little, and when the rods show both angles the same, nail on your strip of wood. Take the lower sash, fix it firmly to the bench side by means of the screw or wedge, strip up the sides so that it will slip easily up and down in its place; do not make it too slack. A good rule is a clearance of about the thickness of a penny; and see that you keep it of equal breadth throughout, for nothing tends so much to make a window lift badly and stick as a want of parallelism in the fitting of the sashes to the case. Next fit down the sole into position,

care, and must not be hurried over, as there is nothing shows so much the botch workman as a badly-fitted window, or causes so much actual discomfort in a house, especially in the winter time, as most dwellers in London know to their cost, for verily the "jerry" builder seems simply to cut off the stumps, tear off a few shavings with a jack plane, and throws them into their place, always taking particular care that they do not err on the side of tightness.

beveling the under edge, and checking the inner face as in Fig. 30; then cut off the top stumps, and plane up the top side of the countercheck fair and level. Put back the sash into its place in the case, and, with a rod, measure exactly the height from the top of the countercheck to the under side of the case lintel; take out the lower sash, and lay it on one side. Remove the parting beads, and fit in the upper sash. When it slides up and down easily, take your rod, and, measuring from the inside of the countercheck, mark off the exact height on each stile; cut off the stumps, and strip up, and your sash will be the proper length.

As to fitting the counterchecks to each other, there are many ways of doing this. One is by the use of a plane which makes a joint similar to that shown in Fig. 31; the other and more common method is to simply bevel the joint as in Fig. 32; this way presents the merit of being easily done. I must say that I prefer it to the other, as it does not harbour dust, and permits of a very close joint being made when carefully fitted. The joint made with the plane, on the other hand, has an advantage in that it will not allow of the burglarious insertion of a knife to open the fastener with. The choice of methods in this detail I will leave to the workman, and describe the simplest of the two. Bevel then the countercheck of the top sash, cut it down with your dovetail saw at  $\frac{5}{8}$  inches from each end, and to the level of the face of the sash, remove the outer piece carefully with a sharp chisel; this allows of free play to the parting bead; put the sash in the case, let it rest on the sole until you put the parting beads back into the grooves, then raise the sash to its position at the top of the case, and keep it there by jamming a strip of wood from the sole to its under edge; take the lower sash, and fit the countercheck to the upper by beveling it until you have a close joint above and below, and also the lower sash resting close against the parting beads, cutting out a small piece at the ends as before, to allow of the beads working. Fit in your baton rods by stripping them to such a width as will allow them to have the bead just a shade under the

flush of the inside facing when they are close to the sash. Now, the sashes being fitted, remove them, and run in the centre of the framing a  $\frac{1}{2}$  inch groove,  $\frac{5}{8}$  inch deep, extending half-way down the sides of each sash. This groove is for the reception of the sash cords.

The sashes may now be glazed, and the case, having first received a coating of good white paint, be put in its place in the building. When fixing the case in position care must be taken to have it perfectly square. This may be accomplished by means of wedges driven in at the four corners under the sole and above the lintel, making sure that they are driven in exactly under and over where the ends of the stiles enter, or you will bend the case. The squareness may be ascertained in the same way as when you fitted the sashes, viz., by means of the baton rods (Fig. 29).

After the sashes have been glazed, weigh them, and procure suitable weights. Should the top sash weigh, say, 28 lb., procure two weights for it of 15 lb. each; the extra weight tends to keep it in its place when closed; so with the lower sash, should it weigh 34 lb., let the weights be 16 lb. each. The favour of the two pounds will prevent it rising from its place when shut down. If the space behind the case be very much confined, lead weights may be used, as they take up less room; but, as a rule, the ordinary cast-iron sash weights may be used.

We can now proceed to hang the sashes, and for that purpose use the *best* sash cord. Cheap sash cord is an abomination, and an endless source of annoyance through broken cords. To hang your sashes, have your weights and cord handy, with a few stout tacks and the sashes lying beside you, top one ready to hand. Take out the rods, beads, and pockets, then with an insignificant but extremely useful little appliance commonly termed a "mouse," which is simply a piece of lead about 2 inches long and  $\frac{1}{4}$  inch square, with a hole at one end, through which is passed a string, you get your cords in their places. Pass the "mouse" over one of the upper sash pulleys, attach the free end of the string to the end of your sash cord, put your hand into the pocket-hole and grasp

the "mouse," which will have fallen down inside the case, carrying the string with it; gently pull on the string, and you will pull the sash cord over the pulley and down the back of the case; take one of the weights for the top sash, pass the cord through the hole in the upper end of it, make a knot to prevent its slipping back through the hole, pass the weight through the pocket, and pull it up to the pulley; stitch the cord to the side of the frame with one of the stout tacks, and cut off, allowing a sufficient length to remain for attaching to the sash. Do the same thing with all four weights; then, lifting the upper sash, tack one of the cords into the groove, taking care that the tacks are kept well down to the foot of the groove, so that the cord may not "bind" on the pulley when the sash is pushed up into its place; put the other cord on in the same way. The sash is now put in its place finally, and the pockets and parting beads replaced. Hang the under sash, which you will find to be much easier done than the upper; put in the baton rods, securing them with three screws, one in the centre, the others midway between the centre and the ends, and your window is now complete with the exception of the inside finishing, which is beyond the scope of this article. Of course if your window is a very large one, and the sashes are glazed with plate-glass, then you must use chains to hang them with. This is a more difficult job than hanging with cord, but the principle is the same, only the weights hang on a hook attached to the chain, and the chain is secured to a plate that is screwed into the stile of the sash.

I should remind you here that if you have more than one window to make at a time of the same dimensions, they must be numbered so that the sashes may not get into wrong cases to which they were not fitted. The numbers are generally marked on the bevel of the counter-checks, and on the side of the case under one of the baton rods. The marking is done in Roman numerals with a  $\frac{1}{2}$  inch chisel in this fashion—VII.

I may also mention here that oak is often used for window cases, and both oak and mahogany for the sashes; but this is only in the highest

class of buildings, as it is very expensive, and I should think it will be beyond the scope of the amateur. I merely mention this thing for the benefit of aspirants with plenty of time, patience, and money.

One thing I may note before closing this paper—that is, that in many localities the word "rebate" is used to denote the recess in the sash framing that receives the glass. I mention this here because throughout this series of articles I have employed the word "check" when speaking of the recess, a term that I have found to be widely used throughout the country.

One thing more—in the first paper I see the priuter has turned the cut of the simple sash there described upside down; the wide bottom rail is thus shown as the lintel, and may have proved confusing to the novice.

## SILK VENEERING.

A USEFUL SUGGESTION FOR AMATEURS.

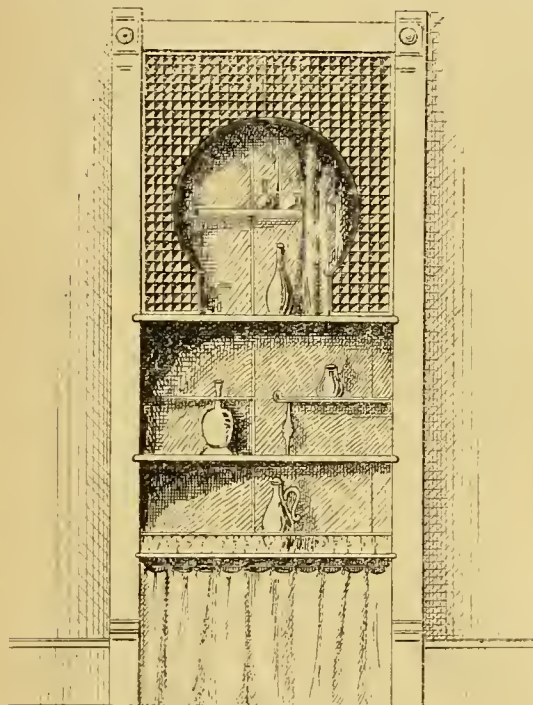


NEW method of artistic decoration which is applicable to wall or furniture adornment, is that of silk veneers; a curious but a practical and excellent idea, and applicable to many forms of decorations which have heretofore been given over to hand-painting. The silk, satin, or whatever material may be used, is drawn tightly and smoothly over the table-top, panel, or other surface to be decorated, and coated repeatedly with transparent varnish. The varnish completely fills up the interstices in the weave of the material, so that after the last coat is applied the appearance of a woven fabric has been lost, and the design and the general colour of the background only appears. The silk used may be a plain colour, and afterwards decorated with a flower spray, or figure piece painted upon it, or cretonne, or even calico, in which the colours are fast, may be used. A successful application of this work was seen in a table-top—a dainty affair, almost too fragile for use—which was ornamented with a very delicate bit of flower work, apparently hand-painted and varnished, but which was a veneering of cretonne, carefully applied, without seam or wrinkle.



## SUGGESTION FOR COVERING A DOOR NOT IN USE.

THE illustration shows a very pretty cabinet that can be made upon a door not in use. It is designed by an American firm of house decorators, and is quite simple and cheap. The top part is an arch of fretted or carved work, about three feet long and as wide as the door. It is held in place by four small screws. The shelves should be one



THE DOORWAY COVERED.

inch shorter than the opening. They can be one inch wider than depth of casings, and are supported by small screw-eyes turned into the casing—one at each corner of shelves. The curtains can be light and soft in colouring, put up on small brass rods, the same as sash curtains.

The details can be altered or elaborated to suit different tastes, but the main idea is full of suggestion for amateurs who can do a little simple carpentering.

## EIKONOGEN.

### THE NEW AND SUCCESSFUL PHOTO- GRAPHIC DEVELOPER.

By "OUR PHOTOGRAPHIC EXPERT."

I.—THE INVENTOR AND HIS PATENT—CHEMICAL DERIVATION OF EIKONOGEN—ITS CLAIMS AS A DEVELOPER—DR. ANDRESEN'S FORMULÆ—MY OWN EXPERIENCES.



HAVE been making careful and exhaustive experiments with the new "Eikonogen" developer—on and off—since its first introduction into this country in June, last year. These experiments, in which I have been most courteously assisted from time to time by Messrs. Marion & Co., of Soho Square, have been mainly conducted for the benefit of the many photographic amateurs who subscribe to this Journal, and I now feel in a position to give them the benefit of my researches; but of what value these may be to my readers, I must leave them to judge from their own trials and experience of the developer itself.

Before entering into the practical details of development, however, it may be interesting to my readers to learn, in a few words, the chemical formation of this developer, for, of course, the word "Eikonogen" is merely a trade or fancy name; and although a German doctor claims to have invented it, I should here point out that it has been known in England for some time; but no one here seems to have taken up its practical manufacture and application as a photographic reagent.

Eikonogen, therefore, is claimed as the invention of Dr. Momme Andresen, of 44, Melchiorstrasse, Berlin. A patent was applied for in England, on March 26th, 1889 (No. 5207), and completed on January 25th, 1890. The specification can be had from the Patent Office for 6d., or it may be found in *The British Journal of Photography* for Feb. 21st, 1890. According to this the chemical

composition is  $C_{10}H_5 \begin{cases} \text{So}_3 \\ \text{O}_3\text{H} \\ \text{N H}_2 \end{cases}$  which shows that

Eikonogen is a naphthol derivative. Dr. Andresen says: "My invention relates to the development of photographic pictures by means

of diamidonaphthaline  $C_{10}H_6 \left\{ \begin{smallmatrix} NH_2 \\ NH_2 \end{smallmatrix} \right.$  amida-naphthol  $C_{10}H_6 \left\{ \begin{smallmatrix} OH \\ NH_2 \end{smallmatrix} \right.$  and dioxynaphthaline  $C_{10}H_6 \left\{ \begin{smallmatrix} OH \\ OH \end{smallmatrix} \right.$  as well as their sulpho-acids" (monosulphuric and disulphuric). Any of my readers who wish to go further than this into the scientific question of the subject must refer to the above-mentioned specification, where all particulars will be found, and I can tell them that they will find the matter vastly interesting.

I now turn to the circular issued by the Doctor, so that we may see what his claims for the new developer are, described, as they are, in unscientific language. Eikonogen, first issued as a chocolate-coloured powder, is now sold in large crystals of a cream colour, and although it keeps better in this form when dry, it is much harder to dissolve than the earlier preparation, which was a crystallised powder. Eikonogen is said to possess far greater developing power than either oxalate of iron, quinol (hydrokinone), or pyrogallie acid, the latter being the nearest approach to it in this respect, but appears at a considerable disadvantage when compared with Eikonogen as regards other qualities.

#### ADVANTAGES CLAIMED FOR EIKONOGEN.

1. The principal advantage presented by Eikonogen consists in the fact that in comparison with other developers much shorter exposure may be given, and yet none of the details are lost.

2. By employing a preliminary bath in accordance with the instructions, the time of the exposure may be reduced still further; but for over-exposure bromide of potassium will be found very useful.

3. Eikonogen imparts a beautiful bluish black colour to the negatives, combined with a delicate deposit, which reproduces the finest details that could not be obtained with other developers.

4. The developing solution can be used repeatedly, and does not turn brown.

5. A stock solution will keep for weeks without losing strength.

6. The use of Eikonogen does not necessitate the maintenance of a fixed temperature in winter, as is the case with oxalate of iron.

7. By following a certain system the most rapid instantaneous pictures can be obtained with all their details.

8. Eikonogen is the cheapest developer as regards price and strength; it does not deteriorate by age.

9. By using Eikonogen a 50 to 100 per cent. over-exposure can be remedied, namely, by using old developing solution with bromide of potassium, or by thinning some fresh solution with two or three times its volume of water, and adding bromide of potassium.

10. Eikonogen is free from poison.

These, then, are the claims set forth for Eikonogen; and my readers shall now learn how far my experience with the developer agrees with them; but I had better first give Dr. Andresen's formula, so that my readers may better understand my remarks.

*Formula No. 1. Development with Separate Solutions.*—A. Sulphite of soda  $1\frac{1}{2}$  ozs. 30 grains; Eikonogen 180 grains; water  $26\frac{1}{2}$  ounces. B. Carbonate of soda 1 oz. 1 dr. 40 grains; water 8 ozs. 6 drms. 50 minims.

*Note.*—Dissolve the sulphite of soda in the water, and then add the Eikonogen. For use employ three parts of No. 1 and one part of No. 2. N.B. Be sure the sulphite is dissolved before adding the Eikonogen.

*Formula No. 2. Development with Single Solution.*—Sulphite of soda  $1\frac{1}{2}$  ozs. 30 grains; carbonate of soda 1 oz. 1 dr. 40 grains; Eikonogen 180 grs.; water 35 ozs.,  $1\frac{1}{2}$  drms.

*Note.*—Dissolve the sodas in the water, and afterwards add the Eikonogen. This solution is used direct for developing without the addition of water. The sulphite of soda must be pure and fresh.

*Formula No. 3.*—For very short instantaneous exposures ( $\frac{1}{1000}$ th of a second), and for increasing the power of the developers Nos. 1 and 2, in cases where the plate has not been sufficiently exposed.

|                                |                                                                                                                                                                     |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sulphite soda 5 parts          | $\left\{ \begin{array}{l} \text{Allowed to cool} \\ \text{and preserved} \\ \text{in a tightly} \\ \text{closed stop-} \\ \text{pered bottle.} \end{array} \right.$ |
| Carbonate of potassium 2 parts |                                                                                                                                                                     |
| Eikonogen 1 part               |                                                                                                                                                                     |
| Water 30 parts                 |                                                                                                                                                                     |

*Note.*—To prepare this developer, place the



chemicals in an earthenware jar, and add the water; stand the jar in a saucepan of boiling water, and bring about dissolution by boiling and stirring.

*Preliminary Bath for No. 3.*

|                                                   |   |                                                                           |
|---------------------------------------------------|---|---------------------------------------------------------------------------|
| Hyposulphite soda 15 grns.                        | { | Place the plate in this bath for one minute, and develop without rinsing. |
| Chloride of mercury solution [1 in 100] 15 minims |   |                                                                           |
| Water 55 ounces                                   |   |                                                                           |

My first experiment was with the single solution, No. 2, prepared from some of the first samples which reached this country. To test this, I exposed some plates last August (1889), on an open landscape, about four o'clock on a dull day. The plates were of the slow landscape quality, the exposure short, and a medium-sized stop was used. The following was the result—

No. 1 plate, *developed with pyro* (Ilford formula). No image. No. 2 plate, *developed with hydrokinone and soda hydrate*. The picture came up slowly, but after much forcing lacked detail and density, *much under exposed*.

No. 3 plate, *developed with Eikonogen*. The image again came up slowly, but eventually the whole of the detail came out, and the resulting negative was fairly dense, and merely required printing from in the shade to make a good picture.

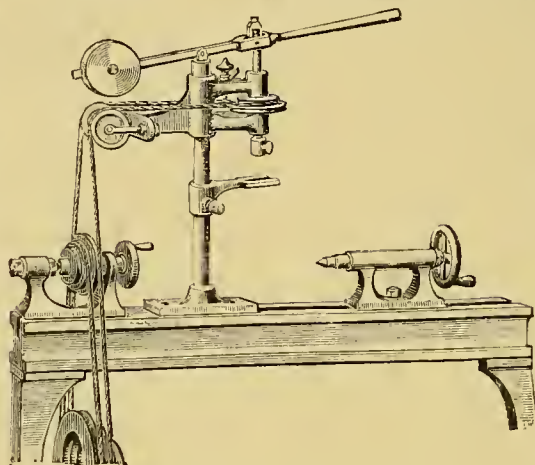
This negative, however, proved most suitable to print from on bromide paper.

## NOTES ON NOVELTIES.

By THE EDITOR.

*Model Engines, Castings, &c.*—Mr. Francis points out that his address is 75, St. James' Road, Forest Lane, Stratford, E., and not 42, as stated in my notes last month.

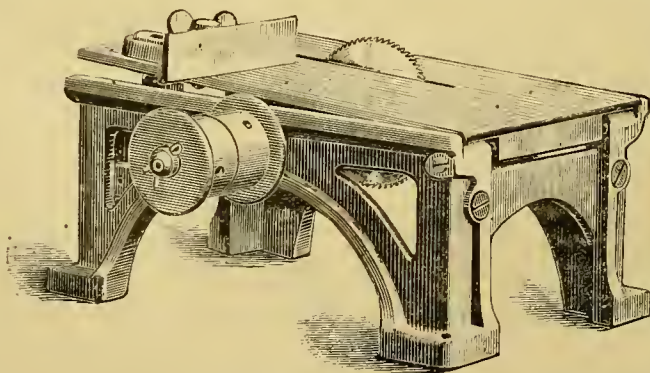
*The Britannia Co.'s Lathe Drilling Machine.*—The illustration, which explains itself, shows a very useful appliance, the price of which, £2 2s., brings it within the reach of many lathe workers. It can be used on any sized lathe, and driven either from below, if for treadle lathe, or from an overhead pulley.



LATHE DRILLING MACHINE.

height of bench, 4½ inches; will take a 3¼ inch circular saw.

*Patent Book-shelf Fittings.*—I have had occasion, in a former volume, to call attention to the patent book-shelf fittings manufactured by Messrs. Tonks, Limited (late Tonks & Sons), Moseley Street, Birmingham. They are particularly suited to the requirements of amateurs who have any intention of constructing and fitting up book-cases. They save an immense amount of trouble, and enable an exact adjustment of the shelves to be made with ease; while the appearance and strength of the fittings is all that can be desired. Messrs.



CIRCULAR SAW BENCH.

Tonks will send illustrations free.

and particulars post



## AMATEURS IN COUNCIL.

For "*Instructions to Contributors and Correspondents*," see p. 46 of this Vol., or Part 13 (New Series), p. 46.

## Paper Veneer.

W. DENT.—The sample you refer to is a specimen of an Austrian production known as "Decorative Wood Veneers," and the agent in this country is—or was—Mr. M. Wilmersdorffer, 72, Finsbury Pavement, E.C. They are particularly useful to the amateur, as they present an easy method of producing real inlaid work of many beautiful and intricate patterns with little trouble and expense.

## Puzzle Money Box.

C. H. GOURLAY writes:—"In the June Part (1890) of *AMATEUR WORK*, I see a puzzle money box. I have the exact thing. I bought it in Blackpool, in 1876; gave 2/6 for it. I took it to pieces, and could not put it together again; laid it aside, and my children put it together when they came from school. I will try again (after 14 years), following your instructions. I do not mean to say the box was easily put together—it is a real puzzle."

## The Hanging Bracket proves a success.

W. J. M. S. writes:—"I have to thank you very much indeed for forwarding my enquiry on to 'The Mock Turtle,' also for his great kindness in replying to same so quickly, and for giving me the hints, etc., that he did. This gave me an opportunity of finishing the hanging bracket earlier than I anticipated, and before our busy season commenced. I have fully carried out his instructions. I am quite pleased with it now it is finished, and must say it will repay anyone who undertakes to make it. I hope 'The Mock Turtle' will take a few more walks in his leisure time, and quiz in the shops, and let us know the result of his walks abroad in your valuable paper, so that his brother amateurs may reap the benefit of same."

## Wimshurst Induction Machine and an Induction Coil.

H. P. S.—Instructions for making a Wimshurst Induction Machine were given in Vol. V. (Old Series), page 363. The construction of a Rhomkorff Coil was described in Vol. I. (New Series), page 214.

## Incandescent Lamp and Battery.

NIGHT LIGHT.—Before answering your questions, let me correct an error that appeared in my reply to C. A. Phelps on page 285. I am there made to say that the battery "will go two or three months": instead of "months" read weeks. (1) Mayfield & Co., 41, Queen Victoria Street, London, E.C., price broken gas carbon at 6d. per pound in their catalogue. (2) The carbous in a battery do not waste, it is the zinc element that is attacked and requires careful amalgamation to prevent local action. (3) The length of time that the bichromate solution will last is dependent upon the work that you require from the lamp. The battery would last longer if arranged so that the zincs could be lifted out of the solution when not in use. It may interest you to know that I have made arrangements for a series of articles on "Electric Lighting for Amateurs" from the pen of a gentleman who is well acquainted with the subject. Before doing anything in the matter you had better wait for these, which will commence early in the next volume.

## Electric Lighting.

DAYBOOK.—Presuming that you wish to have two electric lights equal in candle power to two ordinary gas lights, or to two paraffin lamps, I cannot recommend you to proceed in working out the idea of lighting your workroom with two electric lights supplied with current generated in a battery. For any lighting of such a permanent character as that of lighting a workshop, electric lighting by means of batteries is an expensive and intolerable nuisance. Even if you were contented to have half the light above mentioned, you would find it both expensive and troublesome. It would be otherwise if you had surplus motive power at your command, and cared to make up a dynamo to be driven by a steam engine, a gas engine, or a water motor. Then, although the actual cost would exceed that of gas or mineral oil; it would afford you a pleasurable occupation, and would need no more attention than is required to drive any other machine. I fear you will not relish my advice, but I cannot conscientiously give you any other.—G. E.

## Electric Bell Wires and Gas Explosions.

F. C. I. A. writes:—"I should like to say a few words in answer to Matthew Stickleback's letter in this month's Number of *AMATEUR WORK*, if Mr. Edwinson has not already anticipated my remarks.

"I agree with Matthew Stickleback. that a spark made on breaking an electric bell circuit is sufficient to explode a mixture of gas and air; but for this to take place we first want the gas escape, which is not more likely to take place if the gas pipes form part of an electric bell circuit than if they do not, for no current strong enough to heat the junction of two gas pipes is ever used for electric bell work.

"Having, however, a gas escape, we need not wait for an electric bell wire to break contact in order to explode the gas. Surely there are other much more likely ways in which the gas could be exploded; for whereas a wire in an electric bell circuit might get broken once a year, in a badly put up installation, there is an open flame of some sort in nearly every part of a house for a considerable period every day.

"And is not a wire just as likely to break if earth is not used as a return—→ is it not, in fact, more likely to do so, for then a greater length of wire is used?

"One point more, if I am not taking up too much of your valuable space. For a spark to be caused when our wire breaks, it will be necessary for a current to be flowing through that wire; consequently, unless the electric bell is ringing (and, perhaps even unless a particular room is ringing the bell) when the wire breaks, no spark will be made at the break.

"I think these arguments may set our minds at rest as to its being quite safe to use earth as a return for electric bell circuits."

## Electrical Matters.

GEORGE EDWINSON writes:—"I cannot add anything more to the interesting discussion raised by the question of 'Clericus Secundus,' respecting the danger of connecting electric wires to gas pipes. I quite agree with 'Matthew Stickleback,' that it is false economy to employ gas pipes instead of the ordinary line wires as return leads to an electric bell circuit; but I know that amateur bell-hangers think otherwise. I am well pleased with the articles on batteries by your valued

contributor, Allan Traynor. They should be highly appreciated by all your readers who may feel interested in electrical science. Your experience with the Granule battery is exceptionally good. I had the charge of fourteen large cells (of a Granule battery) some four or five years since, but found them very troublesome, after being set up for a few months, owing to formation of chromic salts in the porous cells. If I had to use the battery again I should employ chromic acid instead of bichromate of potash in making up the depolarising solution. Chromic acid does not form massive crystals in the porous cells like those formed by the decomposition of bichromate of potash. Those crystals are best got out of the cells by soaking them in warm water. You must always discount largely the interested statements of battery inventors and vendors, as these are always highly coloured."

#### Water Developing Dry Plates.

M. W. F. T. writes:—"I was much interested by the article which appeared in your issue for June, on Dr. Buckelandt's Water Developing Dry Plates. I wrote to Messrs. C. R. Bonné and Co., 41, Eastcheap, for full particulars and prices of these plates, and I was much surprised to receive the following reply:—

'DEAR SIR,—We have pleasure in enclosing price list of Waterloo plates, but we do not make the water developing kind any more, because we found the chemicals so ready to oxidise when a box was opened, and if the entire dozen was not used off in one day, but some left over for a week or so, they would lose their active properties. We shall be glad, however, to supply the kind as per list herewith enclosed, and may state that these plates are supposed to be the very best.

(Signed) 'C. R. BONNÉ AND CO.'"

[Will the writer of the article please explain?—ED.]

#### How to Lag a Cylinder.

A. WESTON.—"You do not steam or score the mahogany, but lay it around the cylinder in narrow strips placed edge to edge. In practice the strips are tongued, but not in model work. Brass bands retain the strips in position. The ends of the bands are turned round to form lugs for the bolts, or lugs are soldered on the bands. The thickness

of the strips may be equal to the depth of the cylinder flanges, or less by the thickness of a layer of interposed felt. Felt is an excellent non-conductor of heat, and should therefore be used on all cylinders except the very smallest."

—J. H.

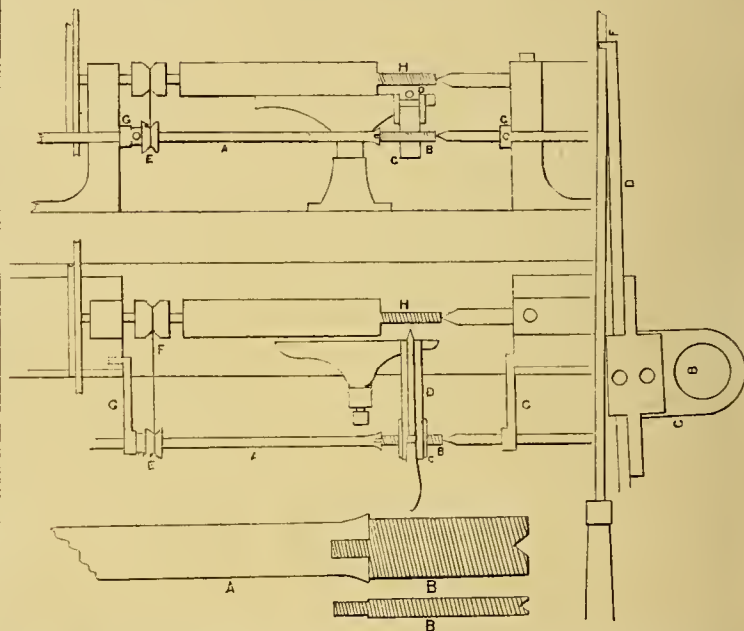
#### An Idea for Screw Chasing.

E. F. MOORE (Portsmouth) writes:—As I am an exhibitor at the Royal Irish Exhibition of a few articles, such as bracket shelves, medicine cupboards, &c., for the ideas of which I am indebted to AMATEUR WORK, I think it but courtesy to inform you of this. I may

When I have time I will send you a few ideas for workshop, which, perhaps, you may find worthy of a small space in your paper. I enclose now an idea of mine for chasing screws, something after the style of traversing bar. In this plan, the nut attached to tool rest should traverse, carrying tool with it. I may add that I have not constructed this arrangement yet, so could not answer for its working.

Articles I have on show would be seen in Sec. 9, Industrial Royal Marines.

[This proof of the great value of AMATEUR WORK to earnest workers is



SCREW CHASING.—A,  $\frac{3}{4}$ -INCH OR ANY SUITABLE SIZE BAR, LENGTH AS DESIRED, SAY 2' 6" TAPPED WITH  $\frac{1}{2}$ " HOLE; B B', SCREWED BOLTS OF SIZES ABOUT SIX INCHES LONG; C, NUT; D, TOOL REST, SUPPORTED BY T REST; E, PULLEY ON BAR; F, CHUCK; I, TOOL; G G', BRACKETS; H, SCREW BEING CHASED.

add that I have been a subscriber to AMATEUR WORK since the commencement, and I am indebted almost entirely to this magazine for what knowledge I have of carpentry, wood and metal turning, carving, &c., having had no professional assistance or instruction.

I can number articles I have made in my spare time by the hundred; the bachelor's sideboard was one I had no difficulty in making.

I make most of my lathe chucks, and have fitted an overhead motion to my lathe, &c., &c.

very gratifying. It speaks well for your perseverance that you have, without assistance, surmounted the difficulties that beset the learner, and during your progress you no doubt picked up many useful ideas. By all means let us have the benefit of them.—ED.]

#### Copying Apparatus.

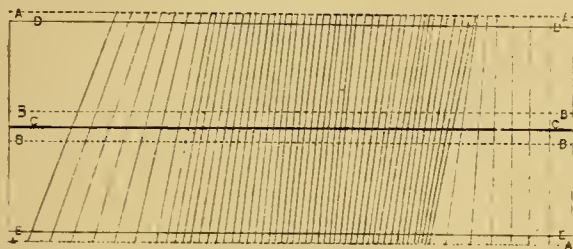
MERCATOR.—A very efficient apparatus for multiplying copies of writings or drawings was described in the last volume, page 211. If this does not meet your requirements, write again, describing more particularly what you want.



**Organ Building.**

R. C. H. (*Salford*).—On a sound-board, 4 ft. long by 1½ in. deep, you might have four stops, but the pipes would all be very small scale. How would this do? Dulciana or small Gamba, Gedact, Dulcet Principal, and a small stopped flute. This would be my selection for a small chamber organ, or for a larger place: Open Diapason, Stopped

drawing-board 1 inch wider than this distance, and at ½ inch draw a line the length of the board to represent *n*, and at a like distance from the other edge mark *e*. On *n* mark the centres of each key, so that the centre of the keys comes right with the middle of the board. On *e* mark the pull-downs, and draw lines from one edge to the other. Then fix the back-fall frame to the

FIG. 1.—SCALE  $\frac{3}{4}$ " = 1 FOOT.

Diapason, and Principal or large flute. These would take up as much room as the four former ones. The notes from CC to fiddle G (or a less number) of the Open Diapason or Dulciana might easily be brought to the front. For these quantities of stops I would not make a bellows smaller than 4 ft. by 2 ft. Figs. 1 and 2 are sketches of pull-down action. There is no definite working scale to them, but from them I think you will gather my meaning, as I seem to have been misunderstood in Part 14. Fig. 1

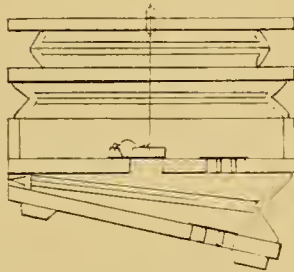
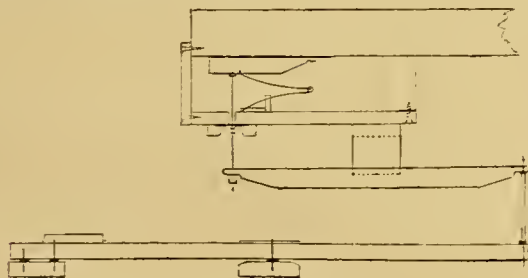
FIG. 3.—SCALE  $\frac{3}{4}$ " = 1 FOOT.

FIG. 2.—SCALE 1" = 1 FOOT.

represents the length of the soundboard. The dotted lines *AA* are the ends of the back-falls, *BB* are the outside edges of the back-fall frame, *c* is the centre on which the back-falls work, *n* is the hole in the end of the key, and *e* represents the pull-downs. To ascertain the length of the back-fall, drop a plumb line from the pull-down and measure the distance between that and the end of the key where the sticker is to work. Get a

drawing-board, mahogany side downwards, and mark up each edge the lines where they touch the frame. Connect these on the top side, and you have the right bevel for each groove. The grooves should be ½ in. deep, and the back-fall centre ½ in. from the top edge of the back-fall. I presume that you will have the sound-board divided so that some of the large notes will be placed at each end. Fig. 1 is supposed

to have six bottom notes of the *c* sharp side to the right. A roller-board with six rollers will connect the keys with the back-falls for these notes. Of course I do not know how your sound-board is set out, but I should think the keys and pull-downs would be somehow like Fig. 1. Fig. 2 represents the action from the keys to the pallet. Fig. 3 is a transverse section of the bellows. With regard to tuning tools, you can get tuning forks and pitch pipes at almost any music-sellers. You tune metal pipes with cones turned in wood or brass. These can be procured from T. Harrison & Son, 168, Drummond Street, Euston Square, London, N.W., or J. Newman, 110, Augustus Street, Regent's Park, London. Stop pipes are tuned by their stoppers, and open wood ones have tuning shades provided, to be raised or pressed down as the pipes may require sharpening or flattening. Reed pipes are tuned by the spring which is knocked up or down with anything flat. A screw driver will answer the purpose as well as anything. No organ tuner uses a file in his tuning.—**ORGAN BUILDER.**

**Varnishing a Map.**

F. W. P. (*Manchester*).—Give the map a coat of Young's clear, patent size, reduced with one-third water. Apply the hot size with a large flat brush very evenly, quickly, and completely. When the first coat is dry, apply another in the same way. When this is perfectly dry, give a good flowing coat of crystal paper varnish, applied with a varnish brush, not a sash tool, as it must be done quickly. The operation should be carried on in a warm room free from dust."

**Watkins' Soldering Flux.**

J. H. Lowe, 2a, Hill Street, Reading, writes:—"In your Notes on Novelties, No. 8, Part 15, you strongly recommended your readers to send to Mr. Watkins for a sample of his patent resinous soldering flux, so I sent for a sample, enclosing two stamps for postage, but I have not yet received it, although some six weeks or more has elapsed. I think it is only fair he should act up to his promise."

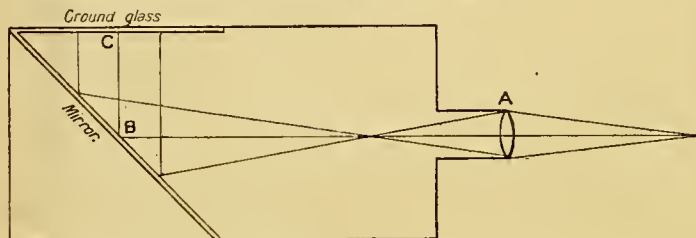
[Mr. Watkins will in all probability see this letter, and will doubtless take an early opportunity of repairing the oversight.—**ED.**]



### Camera Obscura.

W. P. (*Llanfair*) having given the focal length of his lens, he has put the matter in a more definite shape. It is a delicate matter for one contributor to a magazine to criticise the work of another. In fairness to all parties, the writer of an article should be appealed to, as he is responsible for the instruction given, and is more likely to understand the subject; but in this case I presume the Editor has lost touch with him. That being so, I—with diffidence—will try to put “W. P.” right.

On turning to the article in question, in Vol. III., I find that Mr. Earl has omitted one most important matter—he has given the length and depth of the box, but has not said a word about the focal length of the lens. Now, if he had stated this instead of its cost, it would have saved “W. P.”—and possibly



SECTION OF CAMERA OBSCURA.

others—much trouble. Without experimenting, I should give as the focal length of the lens, as suitable for a box of the dimensions given, eighteen inches; this would allow two inches for a focusing tube. It will now be clear why, when “W. P.” “reverses the tube, and puts it inside, he gets a faint picture.” The lens is four or five inches too short in its focal length. One of two ways is open to “W. P.”: Either to buy a new lens of, say, eighteen inches focus, or to shorten his camera by six inches. The former will be the more satisfactory plan. I send a diagram showing how I should make it; from A to B and from B to C must equal the focal length of the lens. “W. P.” speaks of the picture being faint. Need he be reminded that a camera obscura can only be used successfully in a darkened room? The photographer can only see the subject clearly when his head is enveloped in a black cloth. So if the c.o. is used in daylight, the picture will be over-mastered.

I trust these hints will enable “W. P.” to complete his work satisfactorily.—O. B.

### Barrel Organ.

F. H. IRESON replies to “Would-he Organ-grinder.”—“If he will write me, I will send him a sketch. I have the inside of a barrel organ, but no pipes. Address F. H. Ireson, Ivy Villa, Havelock Street, Wellingborough.”

### How to make a Phonograph.

A. J. B. U. (*Ceylon*).—Instructions for making a phonograph, with illustrations in folding sheet, were given in Vol. VII. (Old Series), page 363. I am glad to hear that AMATEUR WORK has been of assistance to you. I frequently receive letters from readers across the seas, assuring me of the value that AMATEUR WORK has been to them, and I find these friendly communications pleasant reading.

easy to decide where the fault is. I would suggest that he should borrow a tool which cuts well with another lathe and slide rest. If it chatters in his, the slide rest is evidently to blame. The steel to be turned should be well annealed, deep centres drilled, and the poppet clamped tight, as sometimes chattering originates there. The clearance angle should be from 3° to 6°, and the cutting angle of the tool 60° to 70°. Point the tool about 45° in the direction the cut is being taken, and it will probably work better. It should be held in the slide rest as short as possible, or a considerable spring would result. The cutting edge of the tool is to be on a level with the lathe centres, and, if anything, somewhat lower than the top surface of the steel of which it is made. Drive slowly, and have tools hard.—J. L. DWYER.

### Draughtsman Wanted.

J. D. (Tiverton).—T. H. Pattison, Chestnut Grove, West Bridgeford, Nottingham, would be pleased to enlarge any patterns that J. D. may wish, as he is a designer and wood-carver.

### Lathe Workers Wanted.

J. JONES (367, City Road, London) writes:—“If ‘R.S.’, whose letter under the above heading appears in the current part of AMATEUR WORK, will kindly communicate with me, I think I might be able to assist him by doing the turning for his model tramcar. I am only an amateur myself, but am also a subscriber from No. 1 (O. S.), and should be very sorry to lose my monthly instalment, as I have picked up many valuable hints from it.”

### Hire of Lathe Patterns.

DAYNOOK.—I am afraid you will not be able to hire patterns at all. Your better plan is to buy a set of castings, and then let your friend fit them up.—J. H.

### LETTERS RECEIVED UP TO JUNE 12.

CO. CAVAN; C. T. VARLEY; E. J. SMITH; FRANK TREMLETT; ERNEST WILLOUGHBY; THOMAS H. HARRISON; CHARLEY FAUST (*India*); B. A. Y.; V. DENT; A. WESTON; S. L. W. (*Plymouth*); W. C.

### Defective Slide Rest.

H. A. writes:—“I have made a slide rest, but I cannot get a tool to cut steel, having tried all angles, from some much too acute to stand, others with very little clearance and no top rake, and many in between, but always with the same result: they all jar, make a fearful noise, and only scrape. The rest has not the slightest shake whatever. Even with a 2-foot bar screwed in the tool-holder no shake can be detected. I have had a little better luck when trying to turn iron, but even then it does not do so much work as a hand tool, or even the same tools used by hand. The rest is 6 inches; tools  $\frac{5}{8}$  inch square steel. Perhaps if any other amateur has had the same experience he would be kind enough to give his remedy for it. I have tried many times, and made many tools, but cannot account for the jarring.”—H. A. ought to be able to get tools to cut steel, as he evidently has some knowledge of metal work. It is not



Four  
Designs  
for  
Turners.

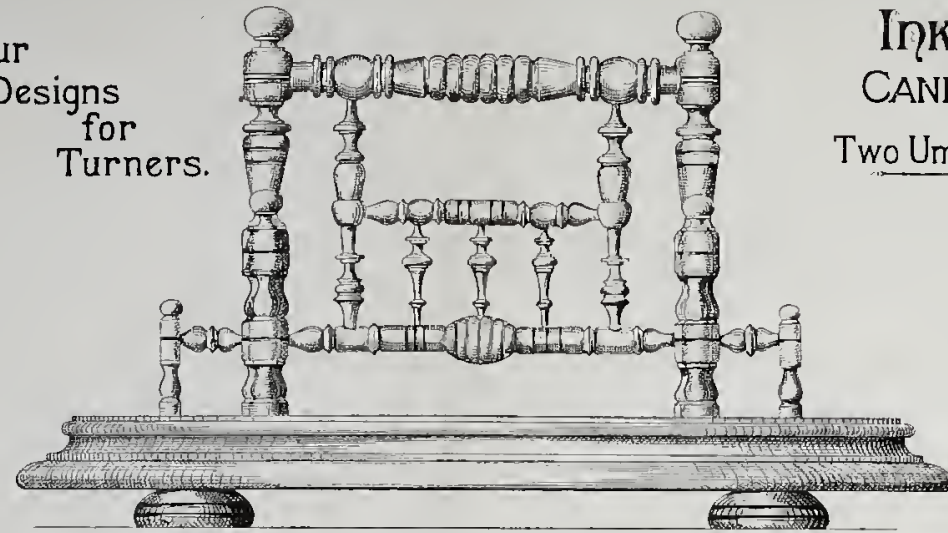


FIG. 2.

INKSTAND,  
CANDLESTICK,  
and  
Two Umbrella Stands.

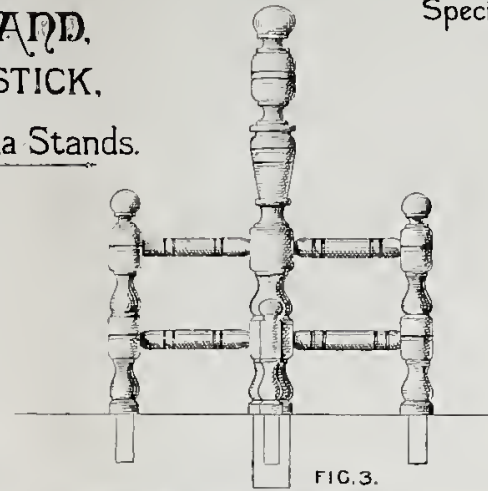


FIG. 3.

Specially Designed for Amateur Work by A. Martin.

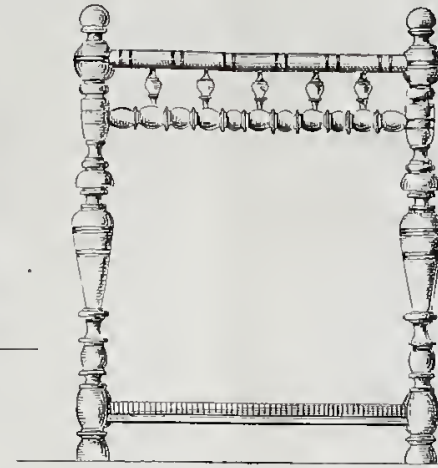


FIG. 5.

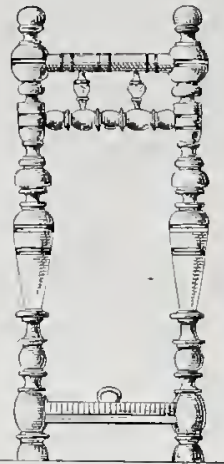


FIG. 6.

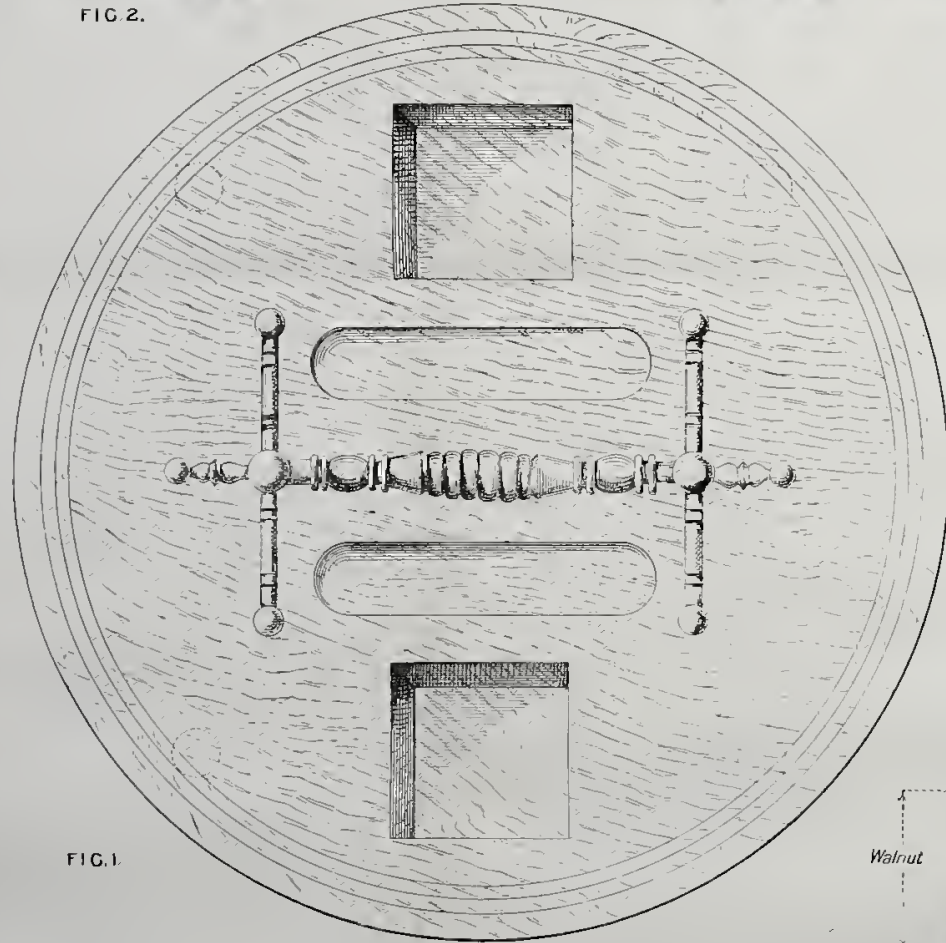


FIG. 1.

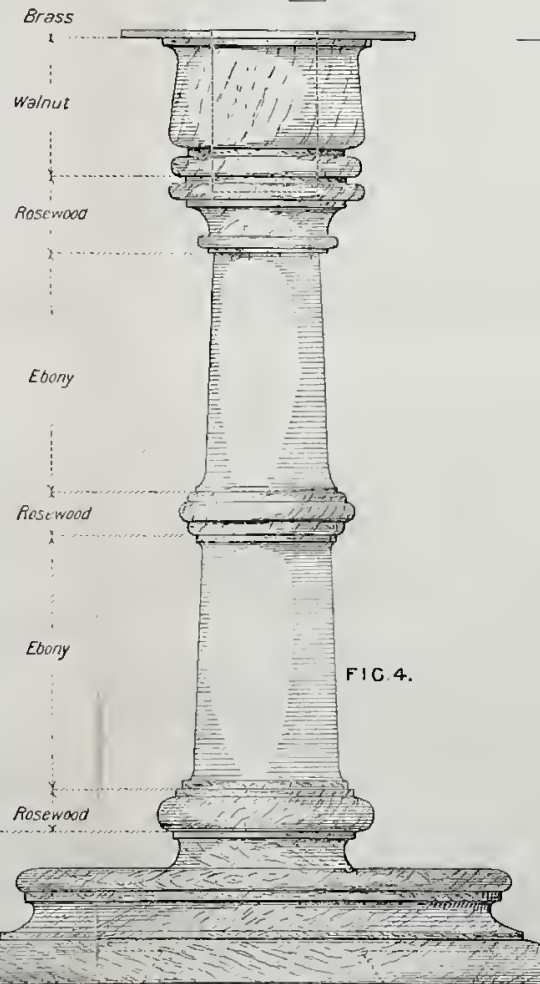


FIG. 4.



FIG. 7.

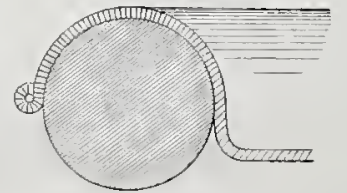


FIG. 8.

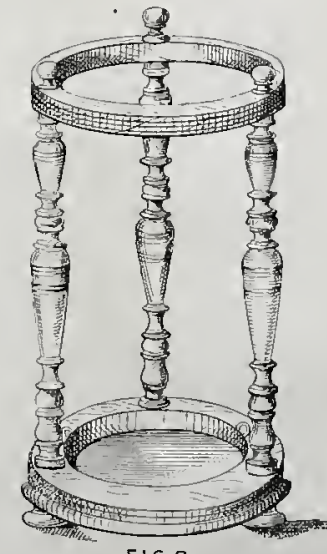


FIG. 9.



FIG. 10.

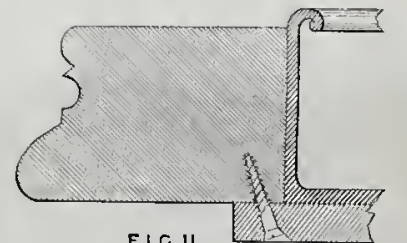
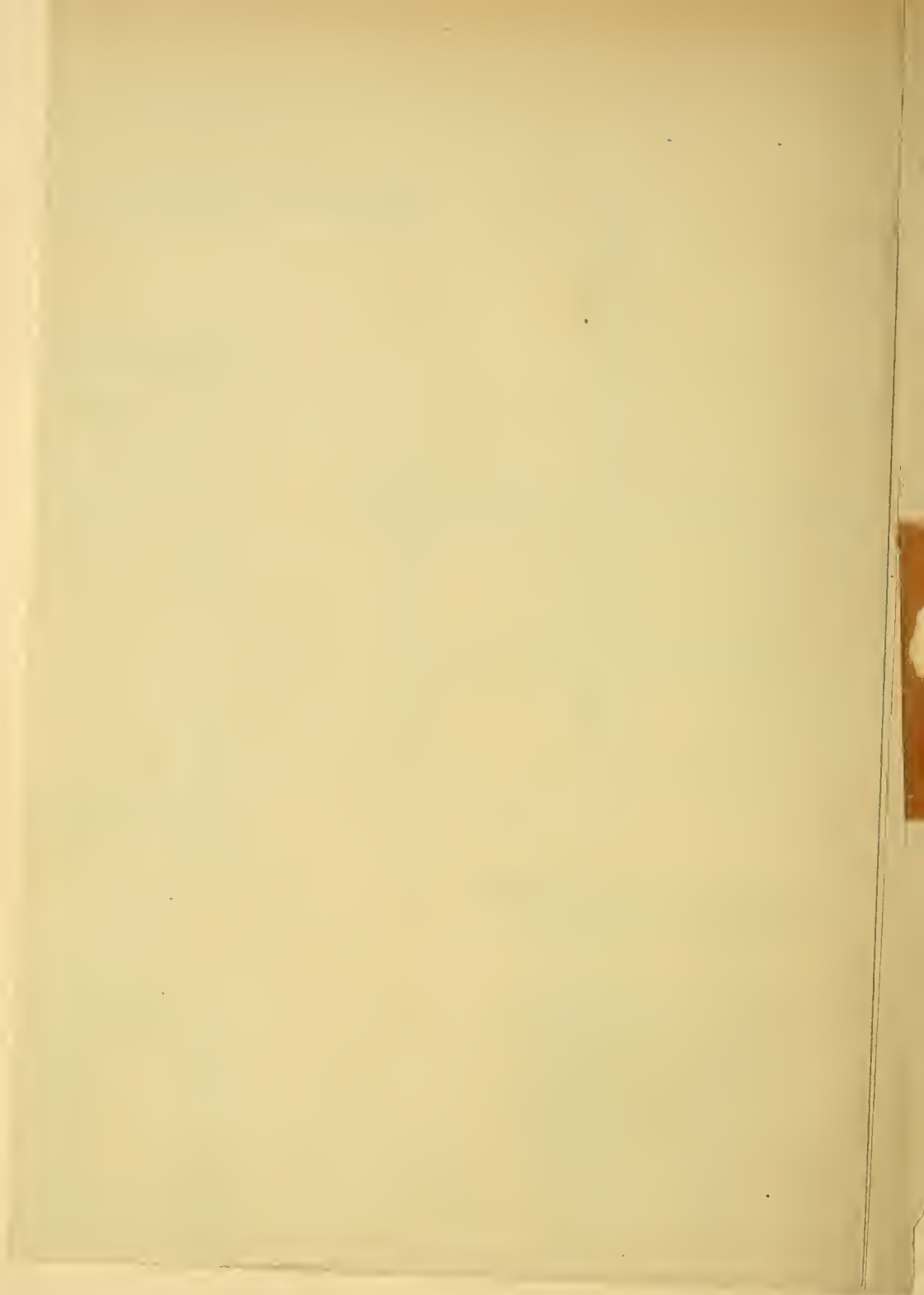


FIG. 11.







## A WOOL WINDER.

By *ELECTRON*.

**THIS** little article is used for holding skeins of cotton, silk, worsted, etc., while being wound. Where any quantity is to be wound, a good deal of time is saved by its use, as the winding can be done by one person instead of two.

FIG 2

Plan view of Winder.

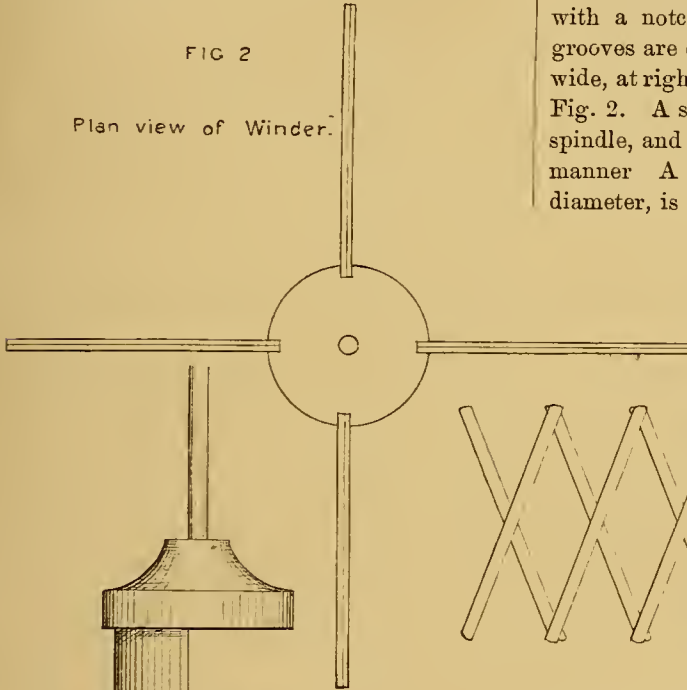


FIG 3

Stand

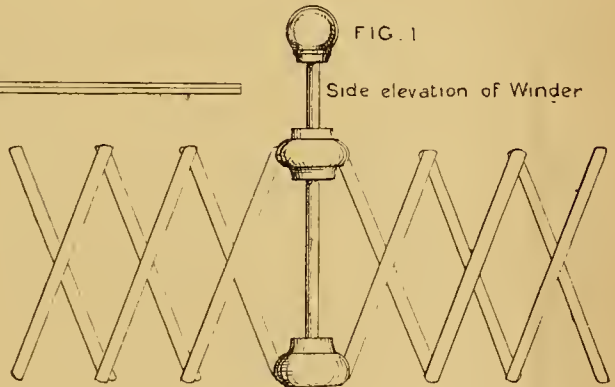


Fig. 1 is a side elevation, and Fig. 2 a plan view. It will be seen that it consists of four movable arms, jointed to a centre. The arms are made of trellis form, and can be moved outwards, to suit any size of material, by pressing down a wooden collar on the centre spindle; a screw is fixed in the collar, by which the arms can be held in

any position; a hole is bored in the centre spindle, which is fixed on an iron pivot on the stand, Fig. 3. A notch is cut in the side of the stand, which is fixed on the edge of a table, and made fast by the screw underneath. The centre spindle is about  $\frac{3}{8}$  inch diameter, and  $6\frac{1}{2}$  inches long; it should be turned, and a hole bored in the lower end  $\frac{1}{16}$  inch diameter, to fit on pin in stand. At the lower end a collar is fixed, about  $1\frac{1}{2}$  inches diameter, turned as shown, with a notch in the edge  $\frac{1}{16}$  inch deep. Four grooves are cut in the edge of the collar  $\frac{1}{8}$  inch wide, at right angles to each other, as shown on Fig. 2. A similar collar is made to slide on the spindle, and grooved and notched in the same manner. A piece of brass or iron wire,  $\frac{1}{8}$  inch diameter, is bent into a ring, leaving a shank

FIG. 1

Side elevation of Winder



about 1 inch long; this must be screwed, and is fixed in the top collar to hold it in any required position.

The arms are formed in six pieces, each  $5\frac{3}{4}$  inches long,  $\frac{3}{8}$  inch broad, and  $\frac{1}{8}$  inch thick; the ends are rounded, and they are fixed together, as shown in Fig. 1, by rivets, or short screws may be used, the heads being counter-sunk. If the points project through, they should be filed off level with the wood; they are fixed in the four grooves in the collars, and a piece of copper wire put through each, and laid in the notch on edge of collars, and the ends twisted together. If the top collar is moved up or down on the centre spindle, the arms will move outwards or inwards, as the case



may be, and they can be fixed in any position by the screw in top collar. The arms, when folded will occupy a space about 4 inches square, and will expand outwards to 12 inches from the centre.

A knob about  $1\frac{1}{2}$  inches diameter is fixed to the top of spindle, to lift it by. The stand is 3 inches long, and 2 inches in diameter, with a  $\frac{1}{16}$  pin fixed in the top, projecting  $1\frac{3}{4}$  inches. A notch is cut in one side, and a wooden screw fixed underneath, by which it may be fixed on the edge of a table. The winder may be made of beech, sycamore, or boxwood varnished, and the arms of lime-tree or other white wood, left the natural colour of the wood.

## AMERICAN ORGAN BUILDING.

*By THOS. L. WINNETT.*

### VII.—THE OCTAVE COUPLER ACTION.



THE next part to proceed with is the octave coupler; but before commencing any work upon it, perhaps I had better explain the various kinds of coupler in use, so that we may go about the work with a better idea of what we are doing. There are several kinds of couplers to choose from, *i.e.*, (1) the super-octave. In this action every note from the bottom key upwards sounds the octave above; it would be very useful if we had a full row of 16 feet reeds, but as our specification includes only half a row, this coupler will not be suitable for our purpose. (2.) The sub-octave; this, as its name implies, sounds the octave below every note struck; it is not often seen in American organs, except in large two or three manuals, and as our instrument is not quite so pretentious as this class of organ, we will turn to the next one. (3.) The subdivided coupler; this, I think, is the action best suited to our wants. From the centre note of the keyboard upwards, the levers sound the octave above, and this part of the coupler is controlled by a stop called the treble coupler; from the same note downwards, the octave below is sounded; this half is also controlled by a separate

stop called the bass coupler. It is very convenient to have the parts separate, as many more effects can be obtained; and as we have the last thirteen notes as a manual sub-bass, our bass part of the octave coupler will cause these to sound in a manner that is exceedingly effective, and not at all unlike the 16-foot pedal of a church organ; while at the same time, with the treble half of the coupler drawn, the effect resembles that produced by the mixtures of a fine swell. This is the action, then, that I shall attempt to describe, and will endeavour to make as plain as possible to the readers. The octave coupler complete may be bought of Mr. Marsh very cheaply at 7s. 6d. each, ready for fixing, and I should advise those who can, to buy, rather than attempt to make the action. Still, there must be some to whom the necessary coin is not always to hand when wanted most; so, for the benefit of those who I know our worthy Editor seeks to help the most, *i.e.*, those who are trying through much difficulty sometimes to help themselves, and to do the best they can with the small amount of money at their disposal, I will try to show them how they may save the bulk of the price paid for an octave coupler complete. I may say that it is perfectly possible, and quite within the range of an amateur's work to make it; and if the parts are carefully put together, it ought to be as effective as the bought one. But please bear in mind this caution: you must on no account attempt to sell the coupler in any shape or form, as it is a patented article, and nowadays patentees are always on the look-out for some unfortunate wight who has transgressed against their rights; still, there is no reason against the amateur making one for his own use. The action is very simple, and is known as Wilcox's patent. Now look at Fig. 51; you will see a piece of board  $31\frac{3}{4}$  inches long, and about  $2\frac{1}{2}$  inches broad, divided into two parts by a saw cut somewhere about the middle. This board, or rather these two parts, are hinged along their length by linen hinges to another strip of wood of the same length, and in one piece from end to end. Upon the top of the board wire levers are fixed, as shown in the illustration. This board, with its levers, is placed on the top

of the swell cover in the place left for it in front of the plungers (see Fig. 58). The top 19 plungers have collars (F, Fig. 58) slipped over them, similar to those used for the sub-bass action; and the last 18 plungers likewise have collars, but as those already used for the sub-bass will also actuate the coupler, only five more need be added to the bass portion. Now let me describe the working. If you look at Fig. 58 you will notice that the underside of the key H has a little button screwed into it; when the key is pressed down, the lever C (of which Fig. 52 is a full-sized drawing) also presses down, at its extreme end, the collar F attached to the plunger G, which, of course, you will understand is the collar and plunger attached to the key an octave higher than the one with the button affixed to; it is impossible to show this in the drawing, for obvious reasons. The coupler is brought in or out of action by means of the bent wire H, the movement of which allows the coupler board to drop below the level of the stud E, at the same time causing the end of lever E to come away from the collar F. The only real difficulty in making the coupler is the bending of the wires to their proper size and shape, so that when they are placed on the board side by side, each may coincide with its key button and plunger collar.

First make the foundation board; find a nice smooth piece of beech, and cut it  $31\frac{3}{4}$  inches long by  $2\frac{1}{4}$  inches broad, making a bevel on one of the long edges as shown in A, Fig. 53. The parts B and C you will notice are shown in two parts in the drawing; that is, because the octave coupler supplied new has only the part B included with it, C having afterwards to be added, and the depth varies a little with each instrument; but as we are making the whole thing, there is no reason why B and C should not be made in one piece; we must therefore make it  $\frac{7}{8}$  inch deep,  $\frac{5}{8}$  wide, and  $31\frac{3}{4}$  long. Attach this strip to the board A by six small pieces of linen placed at various intervals, glueing them alternately in the same way as the lifters are hinged. (See commencement of Chapter II.) Over these strips, on the top of the board, make secure by glueing a  $\frac{3}{4}$  inch strip the whole length. This will make a good hinge, and quite secure.

Now for the coupler wires. Procure some No. 12 iron wire, and bend to the pattern given in Fig. 52 (drawn the actual size). The length and all measurements and angles *must be exact*. The ends have to be flattened out to the shapes shown in the illustration. The best way, I think, will be to heat the ends to a dull red in the fire, and flatten out with the hammer. Notice that the long end of the lever has a double bend at A, first upright for about  $\frac{1}{4}$  inch, and then horizontal, as the lever lies on the board. The bending, as I said before, is somewhat difficult to describe, but after a few experiments, and a little study of the diagrams, I think you will understand the *modus operandi*. We shall want nineteen levers for the treble portion of the coupler, all bent exactly alike. Next cut out of a piece of brass, of  $\frac{1}{16}$  inch thickness, for the clips shown in Fig. 56, We shall require two for the fastening down of each lever; one at each end, close to the bends, as shown in Fig. 52. The position of each lever on the board will have to be ascertained by actual measurement, so we will fix the foundation board in place, having first cut with the tenon saw the *board only* into two parts; not the slip to which it is attached. The saw cut (A, Fig. 51) should be  $16\frac{1}{2}$  inches from the treble end when the board is placed in position with the slip side towards the plungers (see Fig. 58). Screw it down to the swell cover by screws running through the slips, and prop up temporarily the other parts of the board into a horizontal position by means of a slip of wood of the necessary thickness. The keyboard above must now have some attention. Take all the keys off their pins, and lay them somewhere in proper order, leaving the key frame fixed to the bearers. Now take one of the wires, lay it in position on the board, with the short lever end in front of the top plunger, and projecting over the board just a quarter of an inch. To find the position of the longer end of the lever, count from the top of key frame at the back thirteen pins downwards; take up the key belonging to it, and set it in position. The long end of the lever underneath must now be in such a position that the flattened part is directly under the key, and so that the button to be fixed into the key will be 2 inches away from

the plunger. The wire must now be fastened down by means of the clips driven into the board; a bushing of red cloth must first be inserted between the coupler wire and the clip; at A, Fig. 56, the shape of the cloth is shown, and the same figure illustrates the mode of slipping the cloth round the wire before hammering down. In actual work, the cloth should fit tightly round the wire; but in the drawing it is opened out to make the matter more plain to the uninitiated. The holes in the board to take the clips should be made with a

the exact shape of wire, take a piece of tracing paper, and trace over the illustration, Fig. 52. The shape and bends of the wire will then be ascertained by turning the tracing paper over and looking at the back. Eighteen levers only will be required for the bass side, and they must be fitted in the same manner as the treble side, commencing from the *bass* end. Of course they will lie on the board at a different angle to those at the treble end.

It would greatly add to the free working of the wires if they are all sent to Sills and Co. to be coppered over; this would also stop all corrosion, rust, etc., and the cost is very trifling.

We will now proceed to make the collars to slip over the top nineteen plungers; likewise five, to complete the number at the bass end; as I said before, the last thirteen are already in position for the sub-bass, and with a little fitting they will do for the purpose of the octave coupler. The

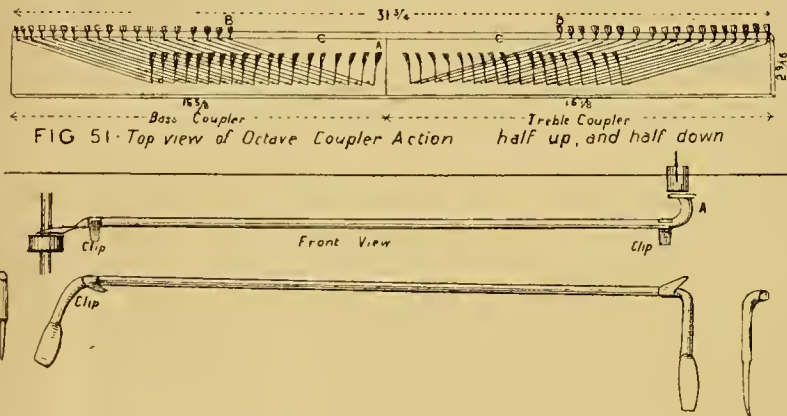


FIG 52 Octave Coupler wire, half actual size.

bradawl prepared for the purpose, and which should be one of large size, ground flat on both sides to the same thickness as the brass clips, and sharpened like a chisel on the oilstone, so that you may be enabled to make the holes in the board the exact size and shape of the clips. Of course, in making the holes the bradawl must not be twisted round, but be pushed straight into the wood; nor must it be allowed to follow the leading of the grain, otherwise the clip will fall out of its proper position. I must not omit to say that the clip at the short lever end must be inserted on the *inside* of the bend, while at the other end the clip will come on the *outside*. The nineteen levers will have to be fitted in this manner on the treble side of the board. When the treble side has been completed, the bass portion must be done in like manner, excepting that the wires must all be bent in the opposite direction. To find

collars should be turned to the size shown in Fig. 54, and should have a hole through the centre, which should fit the plungers quite tightly, also the top must be covered with red baize to silence the working as much as possible. Buttons, like B, Fig. 58, to the number of thirty-seven, will have to be made in the lathe, and one half of a tapped wire screwed into the end; the other end of the button will have to be clothed with red baize. By the distance this button is screwed into the key, the action of the octave coupler is regulated, and the levers are raised or lowered according to the requisite distance. The position of the button with regard to the keys is shown in B, Fig. 58.

After the foregoing explanation, I think it will not be difficult to see that when a key is pushed down, it depresses the long end of the lever; the motion is communicated to the other end, which by means of the short lever presses



down the collar, with its attendant plunger, belonging to the key an octave above that struck. Now I hope I have made this little matter plain enough for the amateur to make an octave coupler for himself. I must admit that it is not very easy work, but I am sure that patience and

to the plungers and keys. The buttons and collars will also be supplied with the octave coupler. These must be fixed in the manner I have described in the making of the action.

The coupler is brought in or out of action by means of a bent wire *u*, Fig. 58. The shape of

FIG 58

Octave Coupler Action

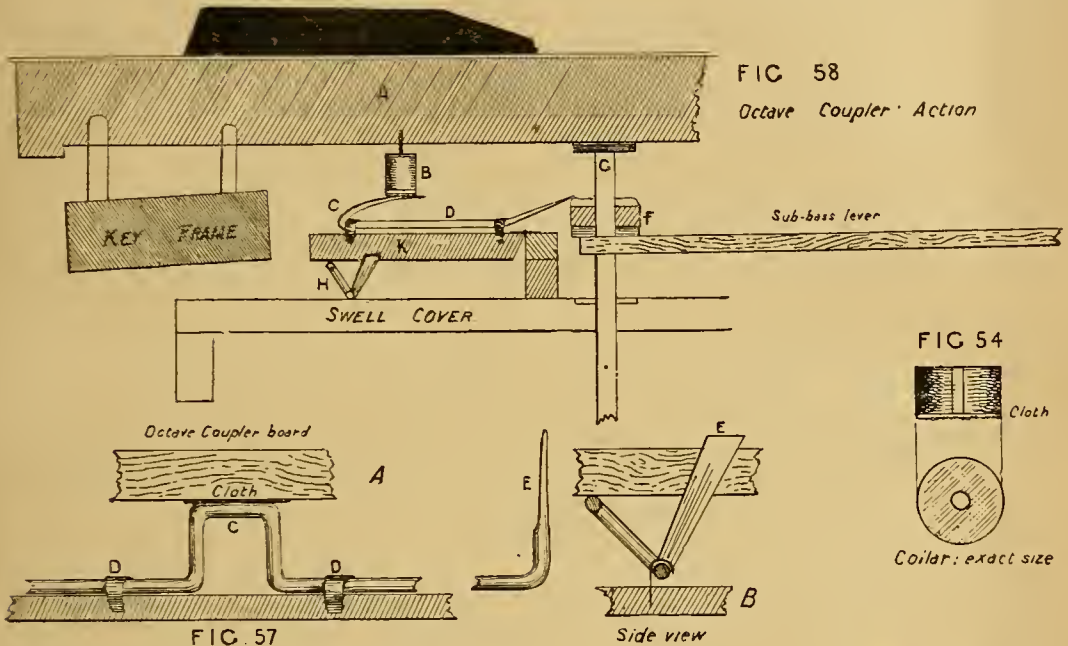


FIG 54

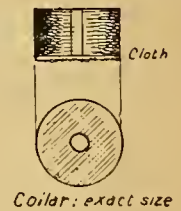
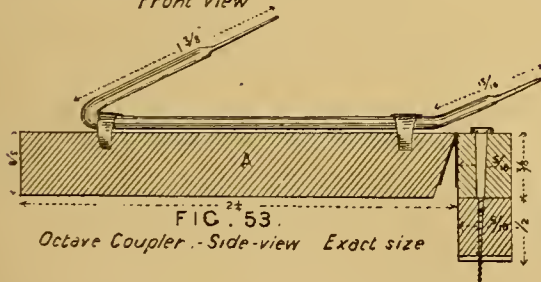


FIG 57  
Cranked wire for bringing on Octave Coupler  
Front view



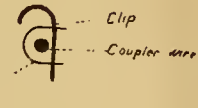
Side view



FIG 56

Method of fixing cloth

round coupler wire



perseverance will enable him to complete the task satisfactorily.

Just a few words on the octave coupler to those who have bought the apparatus complete. The board with its levers attached will be ready for fixing, with the exception of the rail *c*, Fig. 53, which you will see must be prepared and glued on to the swell cover first, afterwards screwing the coupler down, taking care that the levers are all in the exact position with regard

the bend is shown in Fig. 57. It is fixed underneath the coupler board, which it raises into position when the lever *e* is pulled up by the stop action. *b*, Fig. 57, gives the position of lever when in action; when out of action the bent part lies almost flat on the swell cover, and this causes the board to drop with it. Four clips are used for fixing the cranked wire, similar to those used for the octave coupler wires, and they must be fitted with cloth in like

manner. The end of the cranked wire is carried along towards the key bearer, where a hole is made, and the wire brought through and bent up and flattened into the shape shown by *z*, Fig. 57. This part is afterwards to be joined to the stop mechanism, to be described later on. Of course, you will understand that there should be two of these cranked wires, one for the treble portion of the coupler, leading out through the right key-bearer, and the other, actuating the bass part, going through the left bearer. The under part of the octave coupler board should have a strip of cloth glued on in the place where the stop wire will touch it (*c*, Fig. 57).

## EIKONOGEN.

### THE NEW AND SUCCESSFUL PHOTOGRAPHIC DEVELOPER.

By "OUR PHOTOGRAPHIC EXPERT."

II.—MY OWN EXPERIENCES (*continued*). — SUCCESS — A FAILURE — ALL-RIGHT AGAIN — EXPRESS TRAINS AND AN EXPRESS DEVELOPER — EIKONOGEN AND "MAWSON" PLATES FOR INSTANTANEOUS WORK IN THE STUDIO — FOR LANTERN SLIDES, TRANSPARENCIES, AND BROMIDE PAPERS — MY CONCLUSIONS — RELIABLE FORMULÆ.

**T**RIED next day on further subjects, using quicker plates, but using same stop and giving the short exposure as before. The pyro developed plate again failed to give me a printable negative; from the hydrokinone I obtained a thin negative similar to the first plate developed with Eikonogen; and with this last-named developer, used on the last plate, I obtained a splendid negative, full of detail, and half-tones of an extremely pretty colour. This gave me some excellent prints. I next tried the same solution on several portraits, and here found that the solution required a little further diluting with water, after which I obtained some negatives of a pleasing bluish-black tone, with a slight ground-glass appearance on the film, which, to my great pleasure and surprise, yielded prints of extreme delicacy and softness. These were shown to many photographers, both amateur and professional, and although the negatives had not

been tampered with in any way, most of those who saw the prints would not believe that the negatives had not been retouched, until they were shown to them to prove that they "had not received the pencil."

I next made up some solutions after the formula No. 1, and as a two solution developer can be used in a more scientific and useful way than a single solution, I have since adopted it in general practice for portrait work. It acts in every way the same as the single solution, but allows any latitude in exposure. I may add here, that by substituting the same quantity of carbonate of potassium for the carbonate of soda in formula No. 1, that the developer, so altered, may be used for instantaneous exposures up to  $\frac{1}{500}$ th of a second. My next experiments were a series of snap shots of about  $\frac{1}{500}$ th of a second on several Great Western express trains; that speed ( $\frac{1}{500}$ th sec.) being about as fast as, I think, my shutter works. I attempted to develop with a solution, made up after Dr. Andresen's earliest formula, which was sulphite soda,  $2\frac{1}{2}$  drms.; caustic potash,  $1\frac{1}{2}$  drms.; Eikonogen,  $1\frac{1}{2}$  drms.; water, 5 ozs. 2 drms. 13 mins. I here met with my first failures, which were repeated again and again. I soon found, however, that (in my opinion) caustic potash was not suited as an accelerator with Eikonogen; and the reason was not far to seek, for Eikonogen being such an energetic reagent, it does not need such a powerful accelerator as caustic potash, which fogged the plates before the Eikonogen had had time to bring out the detail and necessary density; the development in these experiments, of course, being slow. I think the Doctor has since found this out for himself, as it will be seen on referring to formula 3 that he has now substituted carbonate of potash for the hydrate. On receiving a sheet containing this corrected formula (see No. 3), I immediately prepared a solution according to the directions, and using the new crystallised form of Eikonogen (I should say that my previous solutions had been made with the powdered article). I had now some time to wait before any suitable weather for instantaneous shots arrived, but during the last few bright days (March, 1890) I exposed some few plates, and, again working

the shutter at  $\frac{1}{100}$ th of a second, succeeded in getting some good pictures, full of detail and of sufficient printing density. I have not had time to carry out any very elaborate experiments just lately regarding Eikonogen and instantaneous exposures, but so far, I think, it may be safely concluded that when using Eikonogen, about one-third to one-half the exposure can be given than that necessary for any hydrokinone-hydrate formulæ.

As regards portraiture, I think Eikonogen has a great future in this direction, and I can confidently assert that for short studio exposures on dull days in winter it is simply invaluable when used with the "Mawson" rapid plates, especially if the Fradelle and Young solutions are used (see formula No. 5, at end of chapter). This eminent firm of Regent Street photographers speak very highly of the merits of Eikonogen as a developer, remarking in a letter to the Press, as follows:—"The developer is undoubtedly very powerful, as, *with the sole addition of sulphite of soda*, it is capable of producing most excellent negatives, but at a slower rate than when used with carbonate of soda." The results obtained with this developer, when used on lantern plates and transparencies, are superb, the transparencies being of good density and of exquisite detail. The colour of lantern slides produced by Eikonogen varies according to the strength of the developer. With formula No. 6 the colour is a clear bluish black in the deep shadows, graduating down to a beautiful grey in the lighter portions of the picture. If a developer is used containing one-half the quantity of carbonate of soda, and twice as much water, and a longer exposure be given, the tone obtained is much warmer, and is of an olive-brown or grey colour, very soft and pleasing.

For developing bromide prints, I can recommend either No. 1 or 2 formulæ, as I used up the whole of my remaining single solution for this purpose with good results. For black tones, have the solution strong, and use fresh for every two prints; for grey and warm tones use a weaker solution, in which as many as four or five prints may be developed.

Old solution which has been used for developing not more than two plates, gives splendid

results on bromide paper, and, when dry, the prints have a soft silky appearance, which I have not obtained with any other developer.

In the opening part of this paper I gave the claims put forth for Eikonogen by its inventor, and, on the whole, I must admit they are substantially accurate, the following being my own individual findings upon the subject:—(1.) Much shorter exposure may be given than with other developers. (2.) That the preliminary bath hastens development, and gives more density in instantaneous work. (3.) The solution can be used again and again, but eventually turns brown. (4.) It does not stain the plates nor hands. (5.) It acts energetically, and has great developing powers. (6.) It is not dear, costing about twelve shillings per pound.

In taking into consideration the price, we must remember that each drop of solution may be used several times over, whilst pyro and oxalate of iron can only be used once, as a rule. The whole of my experiments have, so far, been conducted on a widely different basis to those undertaken by the great men in the photographic world, for whereas they have attempted to compare Eikonogen with pyro, by making solutions from percentage and pyro formulæ, I have followed Dr. Andresen's directions throughout, and have consequently succeeded where some of our clever scientific experimentalists have failed. I believe, therefore, my own method to be the most rational one, and cannot possibly understand the value of such experiments as those lately conducted in Japan by Prof. W. R. Burton. This gentleman, at first, made up a pyro developer thus:—Pyro, 2 grains; sulphito soda, 10 grains; carbonate soda, 10 grains; water, 1 oz. He also made up another developer with exactly the same proportions, but replacing the pyro with Eikonogen. He then developed plates which had received the same exposure, on the same subject, in both solutions, and he merely discovered what we already know, viz., that it requires a little more Eikonogen in a developer than it does pyro, and that the former requires but very little bromide of potassium as a restrainer. But as this formula suited the pyro only, and not the Eikonogen, the result of his experiments throughout was that he found



Eikonogen much slower than pyro, although it brought out more detail. Now, as Eikonogen is of a totally different nature to pyro, these experiments were not fair. On the other hand, if the Professor had made up a popular pyro developer, and also another of Eikonogen, after any of the Doctor's formulæ, and tested plates which had received the same treatment as regards exposure, in each solution, he would then have found that the new reagent was the quicker of the two. Mr. Burtou, however, throughout seemed to aim at making a careful scientific comparison between the two articles, as chemicals and their respective powers, when combined in equal quantities with the other ingredients, whilst he should have already known that slightly more Eikonogen would be required than pyro, when replacing the latter with it. If he had discovered a new and improved formula for an Eikonogen developer, however, he would have done some good service for the practical every-day photographer. In conclusion, I firmly believe that Eikonogen is a very valuable addition to the list of photographic developers, and will quickly come to the front as it gets better understood. It requires, like other photographic discoveries, some little amount of using in the dark room before a stranger to it can gain an insight into its nature, capabilities, and power as a developer; but with practice these are soon found out, and then success ensues, and our admiration for the results obtained is the natural sequence. A few more hints, which have been overlooked in their proper place, may help the reader in his first experiments with this developer. 1. In developing with Eikonogen, carry the density a little farther than usual, as it loses somewhat in this respect in the fixing bath. 2. Carbonate of potassium develops quicker than carbonate of soda (washing soda) with Eikonogen. 3. Restrain over-exposure with bromide, and do not have the developer too weak, or the negatives will be flat and without density. 4. Powder the Eikonogen in a mortar, and dissolve in boiling water, which drives out the air. 5. Take especial care that the sulphite of soda is *thoroughly dissolved* before adding the Eikonogen. 6. Eikonogen and sulphite of soda in solution is of a bright

bottle-green colour, and, if properly prepared, will keep good and clear for three months. A solution of Eikonogen only is firstly of a pale yellow tint, which rapidly darkens to a deep brown. 7. Always use distilled water and *perfectly fresh* sulphite of soda of best quality only. 8. Do not use the alum bath until plate is fixed and well washed.

Messrs. Marion and Co., 22 and 23, Soho Square, London, W., are the sole English agents for Eikonogen, and supply it at the following prices:— $\frac{1}{4}$  kilo. (8 ozs., 6 drms.), 6s. 6d.;  $\frac{1}{16}$  kilo. (3 ozs., 1 drm., 43 grs.), 3s.;  $\frac{1}{32}$  kilo. ( $1\frac{1}{2}$  ozs., 50 grns.), 1s. 9d. Postage,  $4\frac{1}{2}$ d. and 3d. extra. The other chemicals required can be had in a very fresh and pure state from Messrs. R. W. Thomas and Co., Limited, 10, Pall Mall, London, S.W., who will send their price list on application.

I conclude this paper by giving the most approved formulæ of Eikonogen, which have been made known to the world up to the present date, by some of our greatest photographic guns. Only one firm of dry plate makers have, as yet, issued a formula suited to their own make of plates; this is Messrs. R. W. Thomas and Co., and they can only supply me at present with a sheet printed in Italian; this, I have, however, translated. It is a capital developer, from which grand results can be got, and I will give it, therefore, the foremost place.

#### RELIABLE FORMULÆ, FOR EIKONOGEN DEVELOPERS.

No. 4. *Formule Ieonogeno per lastre Pall Mall di Thomas per lastre istantee (instantaneous exposed plates).*—Solfito di soda (sulphite soda) 100 grammes, or 3 ozs. 1 drm. 40 grs.; carbonato di potassa (carbonate of potassium), 40 grammes, or 1 oz. 2 drms. 16 grs.; Ieonogeno (Eikonogen) 20 grammes, or 5 drms. 8 grs.; aqua distillata (distilled water) 600 grammes, or 21 ozs. 2 drms. (This will keep a long time in a well-stoppered bottle.)

*Note.*—This is a one solution developer. Dissolve with warm water, which when cold is ready for use. If the negative appears a little hard, add to the developer two drops, not more, of a 5 per cent. solution of hyposulphite of soda.

No. 5. *Messrs. Fradelle and Young's Formula for Portraiture.*—A. For normal exposures in the studio: Sulphite of soda, 4 ozs.; Eikonogen, 1 oz.; distilled water (hot), 100 ozs. B. Carbonate of soda, 1 oz.; distilled water, 100 ozs.

*Notes.*—For normal exposures take equal quantities of each, but varied at discretion—in the same manner as pyro and ammonia solutions—according to exposure, &c. For instantaneous work and certain effects of lighting the face, use a stronger solution by reducing the water to 50 ounces in both A. and B. Solutions of bromide of potassium and carbonate of soda, 1 in 10, may be kept in reserve for correcting over and under exposure. These are called 10 per cent. solutions.

No. 6. *Dr. Mitchell's (Photo. Soc. of Philadelphia) Formula.*—For lantern slides and transparencies.

A. Sulphite of soda, 1 oz.; Eikonogen,  $\frac{1}{2}$  oz.; water, 1 pint. B. Carbonate of soda,  $\frac{3}{4}$  oz.; water, 1 pint. (N.B.—The American pint is 16 ozs.)

*Notes.*—For normal exposure take equal parts of A and B, and add 2 parts water. For warm tones, use half of No. 2 only, and give a longer exposure.

No. 7. *Formula by Dr. H. G. Piffard (New York Camera Club).*—With ammonia addition:

Sulphite of soda, 2 ozs. avoirdupois; Eikonogen, 1 oz. ditto; bromide of potassium, 8 grains; boiling distilled water, 1 quart.

(N.B.—The American quart is equal to 32 English ozs.)

*Notes.*—Dr. Andresen forbids ammonia with Eikonogen; but Dr. Piffard says it *can* be used as the alkali, and works beautifully—time alone will show. Dr. Piffard's directions are—To 1 ounce of above solution add from 1 to 2 drops of liquid ammonia; but this should be used only in cases of decidedly under exposure. 1 to  $1\frac{1}{2}$  drops will do for a properly exposed plate. Instead of ammonia, add, if preferred, from  $\frac{1}{2}$  to 1 dram of an 8 per cent. solution of carbonate of potassium, which gives more density than ammonia.

No. 8. *Warnerke's Formula.*—For copying line drawings and engravings.

Sulphite of soda, 40 parts  
Eikonogen, 20 parts  
Caustic potassium, 20 parts  
Distilled boiling water, 100 parts

{ Use 1 part of developer to 3 of water. Restrain with bromide if necessary.

*Notes.*—Dissolve the sulphite, then the Eikonogen, and lastly the alkali. Filter whilst still hot, and store away for use. This developer has been used by M. Maret in Paris, who is working on physiological subjects requiring extreme rapidity of exposure. He had previously been using hydrokinone, but he found a marked increase in the amount of detail obtained when using Eikonogen instead.

No. 9. *Formula by Herr Eugen von Gothard, Herenz Observatory.*—For stellar photography:

A. Sulphite of soda, 200 grammes; Eikonogen, 50 grammes; water, 3 litres. B. Carbonate of soda, 150 grammes; water, 1 litre.

For use—Take 3 parts solution A., and 1 part solution B.

No. 10. *Combined Hydrokinone and Eikonogen developer.*

|                               |   |                                                                                                                                                          |
|-------------------------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sulphite of soda, 300 grains. | { | <i>Note.</i> —This developer possesses the rapid action of the Eikonogen combined with the sustaining energy of the hydrokinone, and keeps indefinitely. |
| Carbonate of soda, 200 „      |   |                                                                                                                                                          |
| Hydrate of soda, 30 „         |   |                                                                                                                                                          |
| Bromide of soda, 5 „          |   |                                                                                                                                                          |
| Hydrokinone, 20 „             |   |                                                                                                                                                          |
| Eikonogen, 30 „               |   |                                                                                                                                                          |
| Water, 10 ozs.                |   |                                                                                                                                                          |

*Note.*—This is the latest phase of a single solution developer, presumably for instantaneous subjects; but I have not yet tried its powers.

#### DR. ANDRESEN'S FIXING BATH.

Plates which have been developed with Eikonogen should be well washed, and will greatly benefit by being fixed in the following bath:—

Hyposulphite of soda, 4 parts; bisulphite of soda, 1 part; water, 20 parts.

The advantages of fixing in this bath are that:

1. The negatives have a perfect tone, which enables very fast printing.

2. This new fixing bath remains, even after frequent usage, clear and water white.

3. The plate need not be bathed in a solution of alum before fixing, and it is, therefore, not



possible for the plate to get covered with a white layer in consequence of insufficient fixing.

This concludes my experience of Eikonogen up to the present date, and I trust any of my readers who may try it, will find it, as I have done, a useful aid to negative making, especially in portrait and instantaneous work, and also in bromide printing. At some future date I may be able to give some further information on the subject.

## A GRINDING AND POLISHING ATTACHMENT FOR THE LATHE.

By A. SAVIL.



UDGING from the number of queries and replies upon the subject of using emery wheels in the lathe, which have recently appeared in the minutes of the "Council Chamber" of this magazine, perhaps the contrivance here described may prove useful to some of our readers.

The great objection to the use of these articles in connection with a good lathe is that the grit, dust, and spattering which are necessarily attendant, are injurious to bearings, and get into the slide-rest, leading screw, etc. I have, however, used an attachment of this kind with a No. 14 Britannia Company's lathe for some time, and have been able to avoid these evils by the employment of the very simple means to be mentioned presently.

Fig. 1 represents a very effective polishing head, which is adapted for carrying small emery and glaze wheels, and is furnished with a taper screw for attaching circular scratch and bristle brushes. It is also most useful for small jobs of drilling, having a nose bored for the accommodation of small drills; and besides these useful qualities, it may very easily be transformed into a jeweller's lathe by being provided with a fixed centre and T rest. This last remark is, however, foreign to the immediate subject in hand, and is made here merely as a suggestion.

The head, as shown at Fig. 1, may be obtained from Booth Bros., Stephen Street, Dublin, for 7s. 6d., which, considering the finish and

efficiency of the tool, is a remarkably low price. For some years I have worked this head with an independent fly-wheel and stand, but, being pressed for room, some months ago I decided to run it in connection with the lathe; and as the result is so satisfactory, and the thing so easily done, I here give my experience.

In the first place, in order that the emery wheel, etc., may be as far as possible from the fast headstock, we require a spindle reaching from the nose of the mandril to the centre of the poppet when the latter is placed at the extreme end of the bed; or, in the case of very long beds, when the poppet-head is placed, say, 2½ feet from the fast headstock.

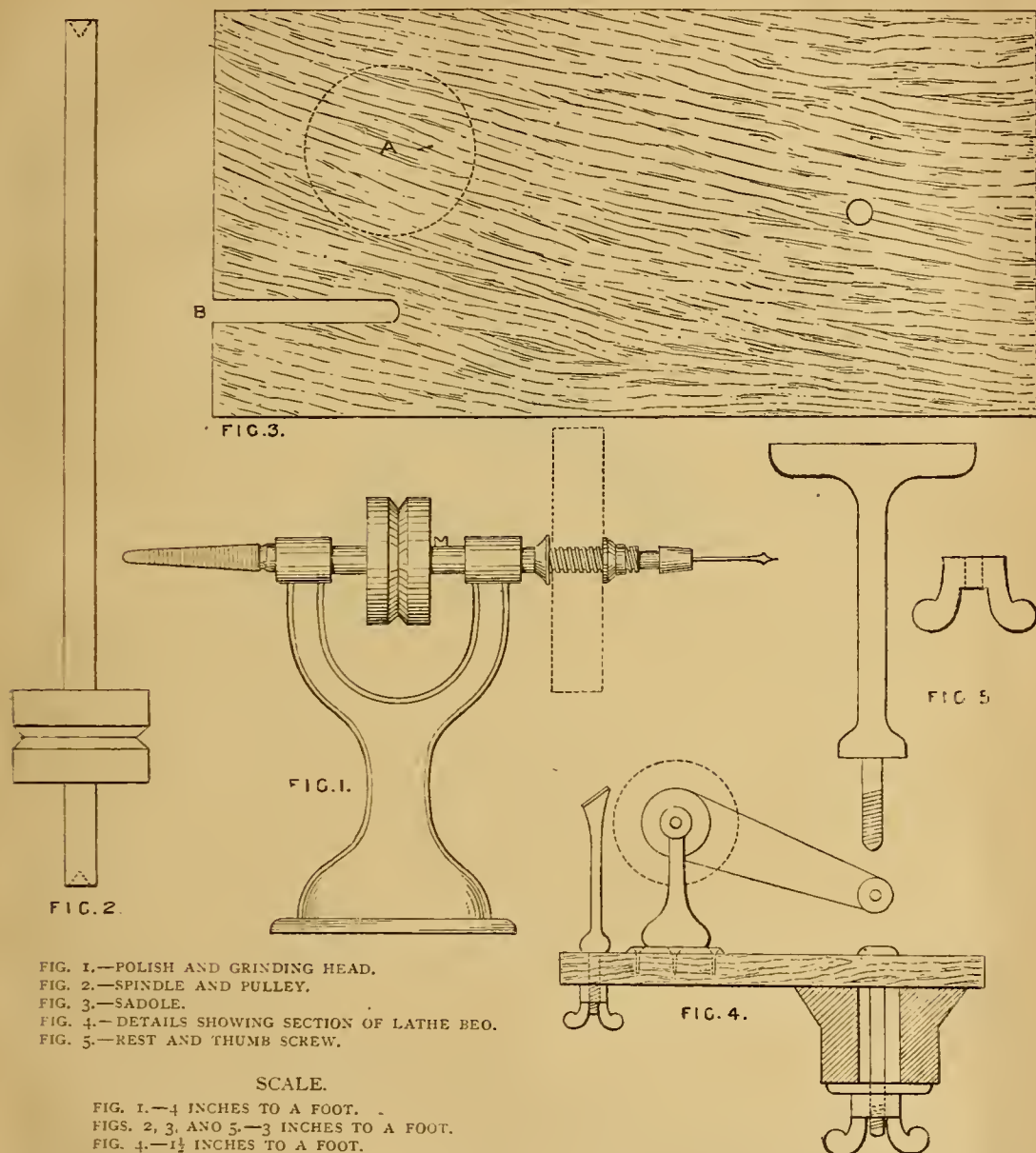
This spindle consists, in my case, of a plain piece of  $\frac{3}{4}$  inch round iron, turned true, running between centres, and driven by a dog, etc. The spindle is provided with a simple pulley of hard wood, with V-shaped groove, to take a small gut band, and placed 2 inches from the right hand end. The diameter of the pulley is 3 inches, and it is fixed on the spindle by means of a key. The pulley should, of course, be fixed and keyed to the spindle in the rough, and then turned, when it will run perfectly true (see Fig. 2).

The saddle (Fig. 3) to which the head (Fig. 1) is attached, and which is secured to the lathe bed when in use, is of beech, or any hard, tough wood, 18 inches by 9 inches by 1½ inches. This is simply planed up square and true, so as to lie level upon the bed, to which it is fixed by a stout bolt, which passes through a plate underneath the bed, and is fastened up by a thumb-screw or by means of a common nut (see details, Fig. 4.)

The head is fixed upon the saddle about 4 inches from the near end (see dotted lines A, Fig. 3), by screws through the base of the pillar, which is provided with countersunk holes for the purpose. This arrangement leaves a distance of about 6 inches between the centres of spindle and head.

The head is fixed to the left side of the saddle, in order that the emery wheel, etc., may run over the centre of the board, so that any grit, water, etc., flying from the wheel may strike the saddle, and the lathe bed, leading screw, etc., may be protected.





The saddle may, of course, be much wider than 9 inches, and might be provided with a small trough; but I find this unnecessary. The spindle pulley and head are to be connected by a gut or round leather band of suitable length, the ends of which are joined by a steel hook and eye in the usual way.

The rest (Fig. 5) will be found to add greatly to the worker's comfort in grinding, polishing,

etc., and if the slot B (Fig. 2) be cut about 4 inches long, the rest may be moved to suit any size of wheel.

Besides the protection afforded by the saddle, it will be advisable, in the case of a screw-cutting lathe, to cover the leading screw with a cloth, and also to have a cover of the same kind for the slide rest; and if these precautions are taken, no harm will accrue.

## A CABINET MADE OF CIGAR-BOXES.

By MIKADO.



VERY handy little cabinet for odd bottles, etc., can be made out of three cigar-boxes. Of course, such a thing will not ornament a parlour, but it answers very well to hang on a bedroom wall, over a wash-stand, or any such convenient place.

Procure three empty cigar-boxes. Two of these must correspond in size exactly, which should be about 9 by  $4\frac{1}{2}$  by 4 inches; the third one can be about the same dimensions, but not necessarily exact.

The first stage will be to get all the paper off. To do this, a good damping all over, inside and out, will be required; and when drying, be sure not to let them dry too quickly, or they are likely to crack. Let the lids come off, because they must be reversed.

When they are all dry, take the pair of boxes, and sandpaper the sides which will be exposed to view, and also the insides of the lids, because when you hang them on as doors you must place the stamped side inside. Should the lids have warped a bit, a little extra drying on the convex side will put it right. Take a few shavings off one edge of both lids, just as much as the thickness of the wood, to allow for the middle piece which is to go between the doors.

Now take the odd box to pieces, keeping the brads, which will be useful later on. Stand the pair of boxes side by side on end, with the sandpapered sides outside, and fit one side of the odd box on top, bringing the edges flush at the front, knock a few brads in, and turn over

and do the same with the other end. Cut a strip just wide enough to cover the two edges in the middle, and of the same length as the doors, two strips about the same width, but only  $3\frac{1}{2}$  inches long, two pieces same width  $\frac{3}{4}$  inch long, and one piece for a shelf about  $4\frac{1}{4}$  by  $3\frac{3}{4}$  inches.

Now for the glue-pot. Put the doors in position, and glue on the strips of linen for hinges, same as were used before, only glueing them inside this time. Glue on the strip of wood down the middle between the doors, and

the two smaller strips on either side of one compartment to rest the shelf on, and the two small pieces as stops for the doors.

An ornament of fret-work can be put on top, flush with the front, with two small blocks glued behind it out of sight. The top part of a wall bracket design will do. Two holes must be drilled in the top part of the back, for the purpose of hanging the cabinet on nails in the wall. Two coats of pale oak varnish will finish it off.

A small button of thin brass screwed on in front, and a ring on each door, will be all the fittings necessary.

CABINET  $\frac{1}{2}$  FULL SIZE.

A NON-ACTINIC SOLUTION.—*The Photographic Times* is responsible for the following:—An aqueous solution of 3 parts of green chloride of nickel and 1 part of red chloride of cobalt appears colourless by transmitted light, and when diluted perfectly clear water. Light passing through the solutions of either of these substances does not affect the salts of silver, neither has it actinic properties when passing through the mixture, notwithstanding it is perfectly white. Sensitised paper exposed to such light for more than a week had not changed in the least.

## A FOLDING TABLE.

By JAS. SCOTT.

**T**HE majority of folding tables are possessed of disadvantages by causing so much trouble in shutting them up and opening them; and it is not always possible to get rid of this drawback. In my design,

made this way it will not be nearly so firm, and will require a greater number of hinges.

In Figs. 1 and 2, the legs attached to the cross-pieces are firmly joined in the usual way, with a framing between them, only the other two needing hinges. The table top will be shaped from a board 30 inches square, and  $\frac{3}{4}$  inch thick. The bottom board will originally be 25 inches square, and about  $\frac{1}{2}$  inch thick. The legs will be 27 inches long, and turned from  $1\frac{1}{2}$ -inch

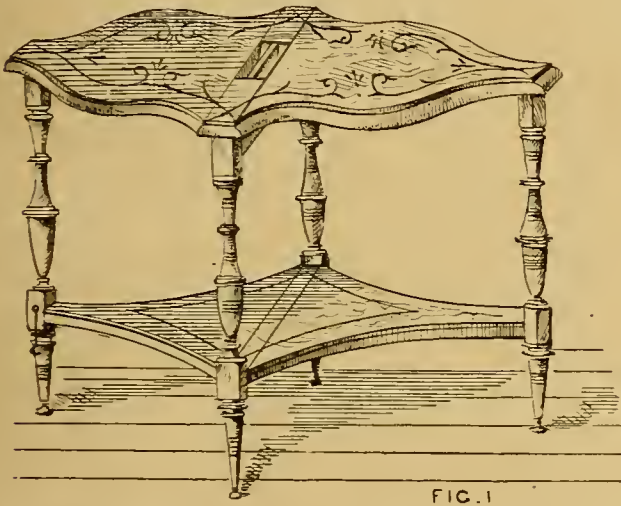


FIG. 1.

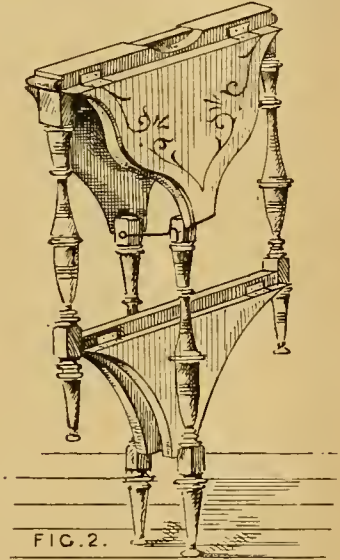


FIG. 2.



FIG. 3.



FIG. 4.

FIG. 1. TABLE OPEN.

FIG. 3. BUTTON UNDER TABLE.

FIG. 2. TABLE CLOSED.

FIG. 4. HANDLE FOR TABLE.

however, this objection cannot be said to hold good. All that needs to be done to fold it is to pull up the centre part of the table, the sides each falling opposite to the other as this is done. To open it, it only requires the top to be opened flat, the bottom board and the legs falling into position at the same time. A small hook attached to the bottom block of one of the movable legs, to catch into a small eye or pin on the opposite block, will keep it from unfolding when shut together. It can be made to close in a similar manner by having the detached middle pieces extending from side to side instead of from corner to corner, as I represent; but if

stuff. The piece cut from the bottom board, and on to which are joined two of the legs, must not be wider than the leg blocks.

Space need not be taken up to describe the hinging; that can be clearly understood when fixing them.

To facilitate opening and shutting the table, cut the middle part of the top, as in Fig. 4, and fix a small piece of wood across the opening for the insertion of a finger. This is really not necessary, as the table can be closed by lifting it.

To keep it firm when open, fix a rather long button on the under side of the above-mentioned part, as in Fig. 3.

Choice of wood and finishing are purely matters of individual taste; but the table would look well in walnut, or in inlaid rosewood.



## THE MYSTERY OF STATIONERY FORWARDING.

### ACCOUNT-BOOK BINDING.

By ALFRED BEAN.

#### IV.—SELECTING SUITABLE LEATHER.



YOUR attention may now be given to the leather adapted to the purpose of covering our ledger. As I have before said, I think coloured Persian calf will be found the most suitable material for an amateur's use, being very easily manipulated, and yet giving good results in the matter of wear. Should, however, the latter consideration be made foremost, red basil is most decidedly the skin to be chosen. It possesses that useful quality in excess of most other leathers in as great a degree, perhaps, as in the additional trouble it gives during the process of covering, which is only excelled in the use of the Russia hide, a leather that, being found as a cover for the very largest books only, will need no further particularising, I think, here. Rough calf is perhaps the next best variety after the Persiau. This has the vice, however, of showing up all the dirt and stains to which it is almost sure to be subjected. Rough goat, which may be distinguished from calf by the coarseness of the wrong side of the skin, is open to the same objection, whilst being also perhaps rather more difficult to handle. For small books roan is very often employed, but this delicate material, I may say, is very troublesome to keep in nice condition, even during binding, leaving out any question of use hereafter. Then as a cheap covering, forril of various colours may be obtained, with a good hope of a lasting wear. This material cannot, however, be made to give the handsome appearance of leather proper. Cloth, except for use in completing the covering when only the back and corners are of leather, is of no use whatever in the stationery branch of bookbinding.

Having chosen, then, the skin most suited to your requirements, a piece must be cut from it according to the style in which you wish your ledger to appear. Supposing it is intended to be

full-bound, viz., covered completely over with the same piece of leather, the usual method of procedure is to first cut a straight edge across the tail of the outspread skin—which end of the hide, by the way, will usually be found to be already the evenest, it bearing generally, moreover, the vendor's private mark. The front edge of one of the boards of the book is next placed at a distance of an inch from the cut, with one of the ends an inch away from the deepest opening into the skin which is likely to be reached when the book is over-turned. The folding-stick must then be run along the edges of the bottom board for the purpose of marking the surface of the leather, the book being afterwards turned over that the other side may be similarly treated. The skin is then cut at a distance of an inch from the lines which have been marked against the ends of the boards, and at  $1\frac{1}{2}$  inches away from the marked fore-edge, the extra  $\frac{1}{2}$  inch allowed to the latter being given in order to provide for the  $\frac{1}{4}$  inch of leather which will be taken up by each groove. Should, however, the skin used be barely equal to the size of cover required, the above method cannot always be pursued. In this case a paper templet should be cut to the exact dimensions, the skin being then measured from that size in a manner admitting of a cover being cut possessing the fewest defects.

So much for full-bound covers, which, although possessing numerous advantages, do not, unhappily, include amongst them that, to a majority of people, indispensable one of cheapness. By these the half-bound method of treatment will no doubt be selected, which consists in covering only the precincts of the back and the corners of the book with leather, the remaining portion being occupied with either bookbinder's cloth or marble paper.

The measurement of the back piece will be that of the rolled back, with an addition to the length of a couple of inches, and to the width of from  $3\frac{1}{2}$  to  $4\frac{1}{2}$  inches, according to the size of the book. The shape of the four pieces for the corners is shown in Fig. 7. The size, of course, will depend on that of the volume for which they are intended.

The leather being cut to suit the manner of

binding, will now require to be bevelled or pared down at the edges, in order to prevent the appearance of that sharp distinction which would, in the case of the full-bound book, be seen through the end paper at the line where the leather terminated, and at the junction also of that material with the cloth in that of the half-bound volume. For the purpose of this operation your knife must of course be exceedingly sharp; it should, moreover, be ground, not on both sides, but somewhat like a joiner's chisel, only with the bevelled edge at a much sharper angle, the opposite side being perfectly flat. The method, I may say, which I have found the best in sharpening these paring knives, is somewhat as follows:—I first (supposing no revolving stone to be at hand) rub the knife, whilst holding it at a slight angle, the cutting edge being to the left, on a flat sandstone, until a burr or roughness can be distinguished on the un-bevelled edge. I then scrape off some of the sand from the stone over a smooth piece of wood or millboard, and rub the flat side over that surface until the burr disappears; a stroke or two on the first side should then bring out a keen leather-cutting edge. In my humble opinion the oilstone is much inferior to sand for this kind of work, the rather rough edge caused by the latter taking better hold of the leather than the finer edge formed by the oilstone. It will be as well, however, to give the knife a slight stroke on the board at frequent intervals, as the edge so soon obtained of course disappears rather quickly.

A square of plate glass, marble, or similar substance, must now be procured as a paring slab, on which should then be laid the piece of leather; the side intended for view being underneath. In paring, the cutting edge of the knife, which must be held very nearly flat, should be at the farther side, and should, after entering the leather, travel from right to left on its edge. If possible, keep the blade in the material the whole length of the cut, the piece, say  $\frac{1}{2}$  inch wide, coming away in one strip; with repeated cuts it is almost impossible to make a clean smooth edge.

The leather after being thus pared should be thoroughly brushed over and over with thick paste. The method of preparing this substance

need scarcely, I think, be described here, seeing the frequency with which the manufacture of that indispensable article is dealt with; though, after all, it deserves the utmost attention that can be given, for without proper adhesion the book must inevitably tumble to pieces long before its legitimate time. However, after the paste has been allowed to sink well into the material, the process of covering may be commenced. In the case of the half-bound ledger, which we had better perhaps consider before the more costly mode, the first portion of the book to receive livery must be the corners. The book then being laid with the fore-edge towards you, lay on each front corner of the top board one of those trapezoids of leather, opening the board for the purpose of placing them in proper position, the margin being made of the same width at each edge; the shortest side of the leather should project outside the corner of the board to the amount of the latter's thickness. Now turn the margin at the ends very tightly over the board, pressing down with the finger-nail the slack portion at the corner, as shown at A (Fig. 8). The front margin must then be tightly folded over, and rubbed down with the folding-stick, after which the ledger should be overturned on to a smooth millboard, where the edges and squares of the covered corners may receive a further bevelling by means of that very serviceable piece of bone.

After then, for protecting the opposite board in the same manner, soak the portion of the rolled back projecting beyond the book at either end with a sponge and hot water, until those ends are quite soft and pliable; if they are very thick and obdurate, a few knocks with the hammer will be very effective in reducing them to proper submission. If the back has been treated in this manner, however, it should, after soaking, be restored to as circular a shape as possible with the fingers; it may then be laid over the centre of the pasted leather back, the proper edges of which should be brought over on to the sides of the boards. Press the overlying leather down into the groove at each side with the folder, the flat side of which must afterwards be used in rubbing the leather into a firm adherence with the foundation.

To turn in the ends, hold up the interior of the book with the left hand, the boards being thrown back on to the bench; this will cause the rolled back to spring completely away from the book itself, and thus enable the leather to be inserted easily into the opening made. You will now divine, I think, the reason for making a division in the folded end-leaf, the unattached end portions of which permit of the free passage of the leather between these and the boards.

After turning in each end in this manner, and closing the boards, lay the book with the fore-edge towards you, and, whilst the left hand,

placed along these divisions, the book, with boards just covering the rope on each side, being then placed under a slight pressure for a few minutes. After thus obtaining proper grooves, lay along them the loop of a piece of strong but rather thin cord which has been tied at the ends with a slip knot. This knot must not, of course, be allowed to lay against any portion of the leather, but should be brought round to either the head or tail, to be there carefully but firmly tightened and secured, the ends being removed to prevent any possibility of their contact with the softened leather, where they would, un-

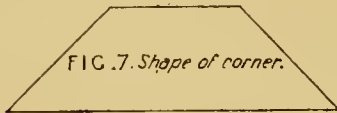


FIG. 7. Shape of corner.

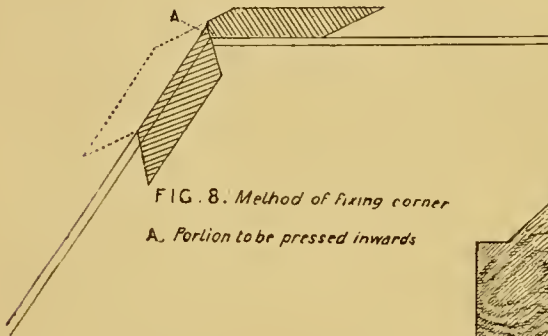


FIG. 8. Method of fixing corner

A. Portion to be pressed inwards

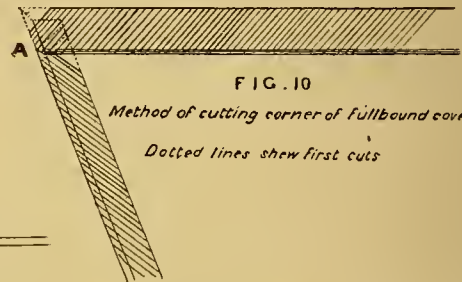


FIG. 10

Method of cutting corner of fullbound cover.

Dotted lines show first cuts

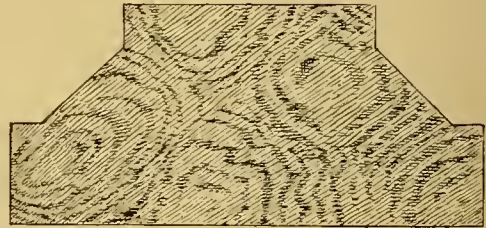


FIG. 9. Cloth side.

being inserted between the bottom board and the end-leaf, holds the leather in place, rub this substance firmly down with the folding-stick. After then overturning the book and repeating this work on the turn-in at the opposite side, open the topmost board and carefully smooth down the leather on the inside of the rolled back; afterwards repeating the whole round of operations at the opposite end of the ledger.

Now remove any wrinkles that may have been formed about the cover during the preceding work, and again press the leather well into the grooves. If red basil be the material you have chosen as apparel for the volume, a piece of soft cord or rope of suitable thickness should be

doubtedly, leave a very unpleasant impress. In the use of roan or vellum, still more care must be taken when tightening the string, for any sudden strain in the case would be almost certainly succeeded by a tear at one of the unsupported portions at the ends.

Now for that critical operation which, in the eyes of the professional forwarder, is considered, not without reason, a principal test of careful work. I mean the setting or bevelling of the head—which also includes the tail—of the leather-clothed back. This seemingly trifling part of the forwarding, you will soon discover, really depends for perfection on the proper execution of very nearly every other portion of the



volume. For instance, should the book not be sewn evenly, or be indented, say, in the rounding, the result will be certain to appear in that small bit of the cover, in which will also be seen the effect of furrowed cutting, a loosely fitting, badly rolled or trimmed back, with boards out of square or at an incorrect distance from their neighbour. Supposing, however, that the rest of the book is in proper order, the operation itself bears no very great difficulty.

To begin with, you must bring the projecting leather over towards the centre of a circle, an arc of which should be formed by the head to be set, by means of the hammer. This should be done whilst the book is resting on each end in turn. Now lay a smooth and straight-edged board at the right-hand side of your table, and place the flattened head of the book to the right-hand edge of this slab, in which position the leather should be brought to the proper bevel—about forty-five degrees—with the flat end of the hammer, the ledger being rolled backwards and forwards to suit the progress of the tool. Sometimes the round handle of a pair of large shears is used also to aid in this formation. In both cases, however, care must be taken to beat upwards, and away from the outside of the back, the effect of any unscientific handling in this respect being much the same, perhaps, as sometimes occurs in the misuse of the human head, viz., the formation on the back of that ornament vulgarly known as a “Charlie.” When you have formed the head as evenly as possible with the hammer or shears, you must give it a final rub down with the folder, which in this case should be held almost stationary whilst the book is made to perform continued half-revolutions. At each of those portions of leather which we have drawn inwards through tightening the string, the head should be moulded so as to terminate in a neat point; the leather on the opposite side of the cord being also pressed to the board if necessary.

After then allowing the book to rest a few hours, to enable the paste to get quite dry, the string may be removed, so as to admit of the sides being affixed. For these cloth (book-binders’) almost invariably forms the material, marble paper being usually considered as of too

unresisting a nature to stand the wear of the office. The size of either should be the width and two inches over the length of that of the board.

All the edges being first, of course, made perfectly straight, one of the long ones should be placed so as to just cover the pared portion of the leather back, to be there held whilst being doubled down to meet the limit of each corner respectively. Now rub your fingers along each folded corner of cloth, so as to make a crease against the edge of the board; you may then with a sharp knife cut through these marks, thus having the side as shown in Fig. 9. By doing this you will cause the cloth when affixed to show straight lines on the edges and squares of the boards, instead of the slanting ones which would be exhibited were the corners to be cut straight off. After glueing these sides in their proper position, you had better once more lay aside the book to dry.

In the meantime let us examine the procedure which should be followed when clothing the ledger in a full suit of hide. First, however, I should mention that in the case of covering with white vellum or forril, the material should, about an hour before using, be lined with white paper, in order to prevent the purity of the parchment being dimmed by the shade of the black board. After paring and pasting the leather as described for the pieces used in the more common style of binding, you must lay on the front half the book to be covered, allowing it, as before indicated, a one-inch margin at the ends, and one and a-quarter inches at the fore-edge. Now draw the further side of the cover lightly over the upper board of the book, pressing into the groove the corresponding portion of the leather. Rub the side and back well over with the flat of the folder to remove all air-bubbles, then turn the book over, and after lifting up the leather from the board now uppermost, repeat the treatment given to the opposite side. The ends of this covering may now be turned in as in the half-bound books. Before, however, clothing the front edges, you must cut with a pair of sharp scissors the two bends which are formed in the leather at each corner of the boards, afterwards reducing the resulting tab to

a point as in Fig. 10, at A; this tab must then be pressed down to the edge of the board.

Now take off a portion of the leather already turned in, by making a cut at an angle of  $45^\circ$  with the edge of the board, and commencing near the corner. You must also cut off the corner of the front turn-in at a distance from the board of its thickness plus the square. This margin should then be tightly drawn over the edge, the corners being carefully beaten with the hammer in order to close their edges. If preferred, however, the edges, when cut, might be pared before being turned in; but the method I have described makes, I think, the stronger



FIG. 1.—ROD ON WHICH TO FORM STICK.

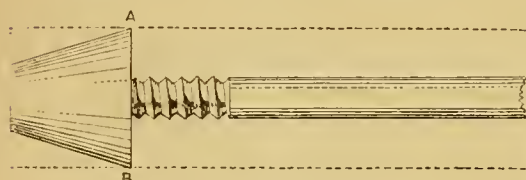


FIG. 2.—NUT FORMING FERRULE.

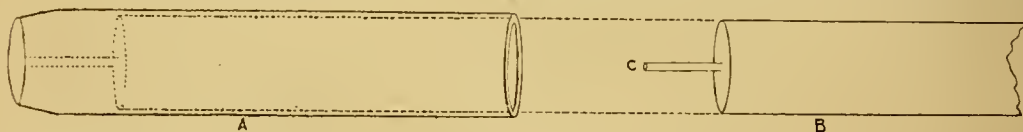


FIG. 3.—PUNCH.

cover, which, moreover, if hammered properly into shape, looks quite as well as if turned in with reduced edges.

The setting of the head is done precisely as before described, so that the only thing now remaining which particularly belongs to the forwarding is to cover up the interior of the boards. Before this is done, however, the book must, of course, become thoroughly dry. The description, therefore, may well stand over till the commencement of another chapter, when I hope to explain, in addition, the method pursued in indexing the ledger, as also—where they differ from those used in letterpress work—the processes of finishing.

## PAPER WALKING STICKS: HOW TO MAKE THEM.

By PROFESSOR L. MARISSIAUX.

**N**OTHING on this subject has ever appeared in this magazine, and I think that many readers will be pleased to see me undertake it. Such sticks, when they are well made, are stronger and last longer than any wooden ones. In fact, if properly made, I do not think a paper stick can break at all.

To begin with, you must get a steel rod about  $\frac{1}{8}$  inch in diameter, more or less—it depends on the thickness you want to give to your stick—and 2 inches longer than the stick is to be, not counting the handle. I used for mine the ramrod of an old flint-lock I found in my grandfather's garret, and it did very well. The first thing I did was to make it of the same diameter throughout by filing it at one end where it was too thick. I next cut it to the required length, and cut a screw thread at each end about two inches long, and made a nut to fit (see Fig. 1), also one more nut, the use of which we shall see hereafter. This third nut you screw on one end on the top of the other, rivet it, and file it round, as shown in Fig. 2,

A B being the diameter the end of the stick is to have. You understand that the two nuts will serve as a ferrule to our paper stick. This being ready, procure four or five bits of iron or brass tube of different lengths, but of a diameter such as will not allow the nuts to enter. Let the tubes be, say,  $2\frac{1}{2}$  feet, 2 feet,  $1\frac{1}{2}$  feet, 1 foot, and 6 inches long. Now get some old books; I say *old*, because in old books the paper is more suitable for our purpose, as it is stronger. If you cannot get old books, procure some brown paper, or some old copy-books, or even newspapers. But you must bear in mind that the better your paper is the more easily you will work it afterwards. I have made some sticks with a mixture

of all sorts of coloured paper, including black and white, and these were very pretty. In paper sticks, sometimes cardboard, and even leather are used; but these are not what I should call real paper sticks, and I should not recommend leather, as it cannot be worked in the same way as paper.

Now we will suppose your old books or other papers are ready. The next thing—the most important and the most difficult to make for an amateur—is a punch to cut the paper in small washers. This tool must be made as shown in Fig. 3; *A* cuts the washer, and *B* makes a hole in the middle of it. In *A* you may see the position of *B* when using the punch. As a matter of course, *A* must be about the same diameter as that of the stick, and *C* as thick as the steel rod. Use a wooden hammer or mallet to punch your washers, as a metal one would rivet, so to speak, *B* in *A*, and prevent your taking it out when wanted, to get off the papers. Do not forget to place your paper, when cutting it, on a piece of lead, or else you will break the edge of your punch.

When all the paper is cut, and in pretty large quantities, we must proceed to the making of our paper stick. Get some good flour paste, not too thin, and soak your paper washers thoroughly in it. Now take your steel rod and thread your washers on it, and, by means of your tubes and nut, press them down as hard as you can, taking, of course, the longest tubes first, and ending with the shortest ones. This is rather long and tiresome work, but “if you want the end you must not stick at the means.” Do not spare any pains to do this part of the work well, because in it lies the secret of success, and if your paper washers are not well rammed on and stuck together, you will be unable to finish your stick properly, and there will be cracks all along it. Now let it dry thoroughly, but do not put it near the fire; put it in a warm room, and in four or five days you will find your unfinished stick as hard as wood.

You will now have to sandpaper it and make it quite round, and just a little less in diameter at the ferrule end than at the handle end, according to taste, and the shape you want to give to your stick. When well smoothed down,

give it a last and sound rubbing with No. 00 sandpaper, and French polish or varnish it. The handle or head will be chosen according to taste and fancy, and screwed or glued on the proper place.

## THE AMATEUR DEMONSTRATOR.

### LIGHT.

By O. BECKERLEGGE.

V.—POLARISATION, WHAT IT MEANS—WHY SOME TRANSPARENT SUBSTANCES POLARISE—ICELAND SPAR—TOURMALINE—POLARISATION BY REFLECTION—MICRO-POLARISCOPE.



As far as we have gone we have made this discovery, that light is subject to two laws—reflection and refraction—and that it may be split up or decomposed into three elementary colours, which by combination produce an infinite number of tints. Having grasped these principles, we are now prepared to make further investigation. We will suppose that we are looking through a microscope which has a polariscope attached. If certain objects are placed upon the stage, we shall not only see the form magnified, but that it glows with beautiful colours. On turning round one part of the polarising apparatus, we shall find the colours change places, one colour fading away, and giving place to that which is complementary to it. The question comes, what has produced the colours? What change has the beam of light undergone? The answer is—polarisation. We have already understood that light is ether thrown into a state of vibration; the ether is not carried forward, only the wave or vibration. It is generally held that these vibrations are perpendicular to the beam of light in all directions, although some hold that the vibrations, whilst perpendicular to the beam, are simply at right angles to each other. Fig. 21 represents a pencil of light in section coming end on to the eye, of course grossly exaggerated, the dotted lines indicating the vibrations perpendicular in all directions to its progress.

Now, suppose we take a transparent substance like ordinary glass; the beam of light suffers no interruption, as it permits vibrations in all



directions. But suppose the glass was strained in one direction, so that the ether vibrated slower in that direction than the other, or was quenched altogether, then we should say it was polarised, or was possessed of opposite conditions. The idea is taken from a magnet. If we take a length of soft iron, and present either end to a magnetic needle, we shall discover no difference in them; either end would attract the needle indifferently. Let us now wind a few yards of insulated wire, that is, wire covered, say, with silk, round the rod, and pass a current of electricity through it; we shall find that the two ends are no longer similar, for on presenting them, one attracts whilst the other repels the same end of the needle. Its ends or poles are different, so we call them N. and S. poles. Now, just as the ends of the rod are in opposite conditions, so a beam of light may be so treated that its two sides may be in opposite conditions. Hence we say it is polarised. Water when freezing is in a different state of tension in lines perpendicular to each other; consequently the ether vibrates more readily in one direction than the other. All crystallisable substances which assume the cubic form fail to polarise. This is what we might suppose, for the lines of force to build up a crystal on all sides equal must of necessity act in all directions equally, so that there can be no difference of tension.

On the other hand, it would seem natural to suppose that in a substance that crystallises in another form than the cube, the lines of force

must act with varying intensity in different directions, so as to produce an irregular form. This is just exactly what we do find. Of all substances favourable to the experimenter in this direction, Iceland spar is the best. This is a transparent form of calcite, or carbonate of lime, and which cleaves into very perfect rhombohedrons. It is a six-sided crystal; the opposite sides are parallel, but not at right angles with each other. Fig. 22 represents a rhomb of spar.

It has the property of splitting a ray of light in two when sent through it in certain directions. Now let us suppose the vertical vibrations in the beam (Fig. 21) are transmitted freely through the rhomb; but those vibrations which are at right angles are retarded, or find a measure of resistance, the result will be that those vibrations, according to the laws of refraction, will be bent away from a straight line, so that the ray, when it comes to the eye, would be split in two, which is exactly what takes place. *a* in Fig. 22 is a beam of light;

the vibrations in one plane meet with no resistance, and are transmitted to *b*, whilst the vibrations in the opposite plane meet with a measure of resistance, and consequently are refracted to *c*. Take a rhomb, and lay it on a fine black line. In one direction there is no difference; but let us slowly turn it round, and we see the line split into two, separating according to the size of the spar. Continue to turn it, and we find the line approach until we see only a single line. Let us substitute a dot



FIG. 21.

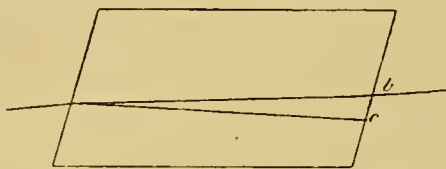


FIG. 22

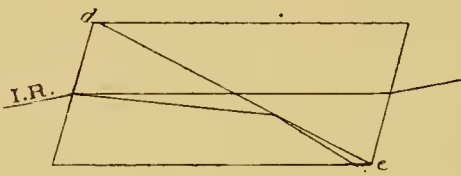


FIG. 26

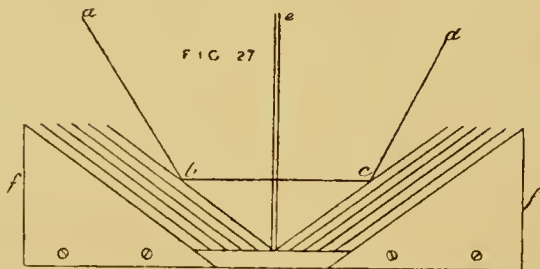


FIG. 21.—SECTION OF A BEAM OF LIGHT APPROACHING THE EYE WITH THE VIBRATIONS IN ALL DIRECTIONS PERPENDICULAR TO THE BEAM. FIG. 22.—RHOMB OF ICELAND SPAR SHOWING DOUBLE REFRACTION. FIG. 26.—NICOL PRISM. FIG. 27.—APPARATUS FOR POLARISING BY REFLECTION.

for a line. We shall now see two dots, and that whilst one is stationary, the other travels round it as we revolve the spar. The effect in this is precisely the same as the other, only the dot allows us to see the longitudinal motion which of course we could not see with the line, unless we were looking at the end of it, when we should see one gradually project beyond the other as they came nearer, and then recede until it projected at the other end. The line or dot that remains stationary is called the ordinary ray, whilst the

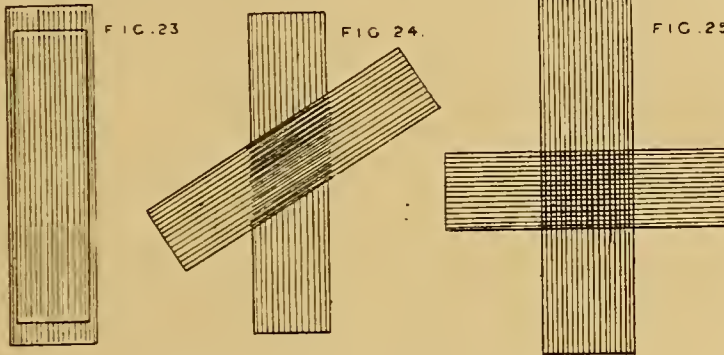
one refracted is called the extraordinary ray. Should any reader who wishes to make the experiment write me through the Editor, I shall be pleased to loan a small rhomb, pro-

vided it is borrowed in all good faith, with the understanding that it is to be returned. Not only can we retard one set of vibrations in a beam, but can quench it entirely. If a transparent specimen of the mineral tourmaline be cut into plates parallel with its principal axis, it presents this singular phenomena, that whilst it transmits one set of vibrations, it quenches or fails to transmit those perpendicular to the same. In Fig. 23 we have a representation of two plates of tourmaline, with their principal axis coincident, with the result that vibrations are transmitted readily. If we turn them round from right to left, or left to right, we see no difference in the light transmitted. Let us now retain one stationary, and turn the other, we shall find that the portions that overlap will grow darker and darker, until the central part is perfectly dark, and fails to transmit any light whatever. How is this? Let us remember that the vibrations are perpendicular in all directions to the beam. Now, whichever way a plate is laid there will be some vibrations coincident with the line of

transmission in the tourmaline, and as we turn it round, whilst it blocks out some, it transmits those that are perpendicular to those that are quenched. If, however, we lay a second plate on the first, and turn this round, as the first quenched those vibrations right and left, and transmitted only the vertical, so the second, being placed at right angles with the other, will quench those that the other transmitted. Consequently both sets of vibrations are destroyed. Fig. 24 shows the light fading; Fig. 25, with

the tourmaline crossed, shows light obliterated. The greater part of the light that comes to us is thus polarised, but without some kind of appliances we cannot discover it. For example, make a

beam of light travel through a rhomb of Iceland spar; further than the fact that it is split in two, we do not see any difference between it and an ordinary beam of light. Fortunately for the amateur philosopher, he can demonstrate polarisation without either Iceland spar or tourmaline. Almost every material except metals will polarise light when reflecting it at a given angle, and every substance has its own angle. The sky polarises light beautifully, or rather, the invisible motes floating in the atmosphere; also water, glass, wood, especially polished mahogany. So there is ample choice of material to work with. Just a word here in reference to a complete apparatus—say for a microscope. It consists of two parts; one known as the polariser, the other the analyser. A small rhomb of spar is cut in two along the plane of its obtuse angle, as shown in Fig. 26, *d e*. These faces are polished, and joined by a cement of Canada balsam. Now, the refractive index of balsam is "less than the ordinary, and greater than the extraordinary index of Iceland spar, it follows that when a pencil of light, *i. e.*, enters one end



FIGS. 23, 24, AND 25.—TOURMALINE PLATES.

of the prism, only the extraordinary ray, E.R., emerges at the other end, the ordinary O.R. undergoing total reflection on the surface of the Canada balsam, so that it is driven on one side, and does not emerge at the other end at all."\* This is called a Nicol prism; one such is placed on the under part of the micro stage, and the light is transmitted through it. Somewhere in the body of the micro—the precise position is immaterial, and only a matter of convenience—is placed a similar prism; this is the analyser. If a film of transparent mica, or selenite, be laid on the stage, it will glow with magnificent colours, and many substances with, and some without, the selenite appear beautiful in the extreme. But such an appliance will cost a pound or two, so we must demonstrate with some cheaper substitute.

Many really beautiful experiments can be performed with bits of glass. The simplest that I know, and one that can be performed by a boy, is the following:—To a piece of thin wood, 6 by 3 inches, nail four angular pieces of cardboard (for these the cardboard should be 4 by 3 inches, and divided as shown); on these lay four, five, or more pieces of thin window glass, with a bit of black velvet, or other non-reflecting body, under them (Fig. 27). A point of light, *a*, will be reflected to *b c*, and again to *d*. If the eye be placed at *d*, no change will be observable; but if we interpose a film of clear mica (such as is sometimes placed over gas burners to catch dust and smoke) perpendicularly, so that the light from *b* passes through it, we shall, according to the thickness of the film, see at *d* a rich display of colour.

#### CEMENT FOR LEATHER AND SOFT RUBBER.—

Cut gutta percha into shreds and dissolve in bisulphide of carbon. The solution should be applied to the parts to be united, and before it dries the parts should be pressed together. Care should be taken to avoid fire with this cement, as the vapour of bisulphide of carbon is very inflammable.

## GALVANIC BATTERIES.

By ALLAN TRAYNOR.

### VII.—CHROMATE OF LIME CELL—SALT WATER CELL—SUMMARY—WORKING DETAILS.

*Chromate of Lime Cell.*—This cell is somewhat similar to the one last described; a large negative surface is employed. In order to have as little internal resistance as possible, a very soft porous cell is necessary.

A rod or narrow plate of carbon is placed in the porous cell, and around it pieces of broken carbon are closely packed. Melted pitch is sometimes run over the top, a hole being left for pouring in the liquid. The outer jar contains a cylinder of zinc. The diameter of the cylinder must be little more than will admit the porous cell without actual contact; and to permit free circulation of the liquid, an opening of half an inch should be left between the edges. The solution for the porous cell consists of  $2\frac{1}{2}$  ozs. chromate of lime, 4 ozs. warm water, and 5 ozs. sulphuric acid; for the outer cell, 3 ozs. sulphuric acid to 1 pint of water. Note that these are only the proportions of the various substances. When in action the cell is almost free from fumes.

Another charge may be used in the cell, by which it will yield a greater E.M.F., but after two hours' work the fumes will become troublesome. The charge (for the porous cell) is in the proportion of 2 ozs. bichromate of potash, 10 ozs. nitric acid, and 2 ozs. sulphuric acid. In the outer jar the charge is water, to which is added a small quantity of sulphuric acid; the cost of this charge is a little more than the other, but there is an increase of force. When out of action the porous jars should be emptied, and allowed to soak in water till again required. The same charge may be used two or three times.

*Salt Water Cell.*—It sometimes happens that a cheap serviceable cell is wanted for light work, such as ringing bells; the cell now to be described answers these conditions. It consists of an outer jar and a porous cell. The outer jar contains a rod of zinc, the porous cell a plate of carbon; for the outer jar the charge is water, to which is added sufficient salt to make it taste

\* Rutley Elements of Mineralogy, page 32.



saltish; for the porous cell the charge is 1 of sulphuric acid, and 10 or 12 of water.

To ring a bell cheaply and constantly, this cell is all that could be wished; with the zinc well amalgamated, all the attention it requires may be the addition of a little water occasionally, to make up for what is lost by evaporation. The writer has had a cell of this kind working an electric bell for almost a year; when the bell refused to ring, it was found that the cell was almost dried up. A fresh supply of water, with just a drop or two of acid in the porous cell, set it to work again.

It only now remains to give some general hints as to the management of cells; and, first of all, with regard to the outer jars. In no case should these be too small, more especially for Daniell, Grove, Bunsen, bichromate, or any modification of these cells. In a small cell the liquid undergoes a rapid change; outer jars of one pint capacity, at least, should always be used, and their rims should be painted with a coat or two of Brunswick black.

The top and bottom of porous cells should always be steeped for a short time in paraffin wax.

*The following table sums up the constructive details of the cells described:—*

| CELL.                | ELEMENT.  |                                 | CHARGE.                                           |                                                                                  | WORK.                                                                                          |
|----------------------|-----------|---------------------------------|---------------------------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
|                      | Positive. | Negative.                       | Porous jar.                                       | Outer jar.                                                                       |                                                                                                |
| Smee                 | Zinc.     | Platinized silver.              | None used.                                        | Sulphuric acid and water.                                                        | Constant current. Electro-deposition of copper, silver, gold.                                  |
| Chloride of silver   | Do.       | Silver chloride on silver foil. | Do.                                               | Weak solution of sal-ammoniac.                                                   | Constant powerful current. Good for intermittent work, bells, and testing.                     |
| Bichromate of potash | Do.       | Carbon.                         | Do.                                               | Bichromate of potash solution and sulphuric acid.                                | Powerful occasional current. For experiments, induction coils. With chromic acid, constant.    |
| Leclanché            | Do.       | Carbon and oxide of manganese.  | Contains negative element.                        | Solution of sal-ammoniac.                                                        | Weak occasional current. Bells, telegraphs, signalling, telephones.                            |
| Daniell              | Do.       | Copper.                         | Sulphuric acid and water.                         | Strong solution of copper sulphate, or sulphate of zinc.                         | Weak constant current. Bells, telegraphs, signalling, gilding, plating, electric-clocks.       |
| Grove                | Do.       | Platinum foil.                  | Strongest nitric acid.                            | Sulphuric acid and water.                                                        | Powerful constant current. Induction coils, electric lighting, medical coils, motors, magnets. |
| Bunsen               | Do.       | Carbon.                         | Do.                                               | Do.                                                                              | Do.                                                                                            |
| Fuller               | Do.       | Do.                             | Sulphuric acid and water, or water only.          | Bichromate of potash solution; or strong bichromate solution and sulphuric acid. | Powerful constant current. Electric lighting or other sustained work.                          |
| Granule carbon       | Do.       | Do.                             | Sal-ammoniac, muriatic acid, and water.           | Saturated bichromate solution and muriatic acid.                                 | Do.                                                                                            |
| Chromate of Lime     | Do.       | Do.                             | Chromate of lime, sulphuric acid, and warm water. | Sulphuric acid and water.                                                        | Do.                                                                                            |
| Salt water           | Do.       | Do.                             | Sulphuric acid and water.                         | Weak solution of common salt.                                                    | Weak constant current. Electric bells and gilding.                                             |

In double liquid cells the two liquids should be of equal height, and the porous cell slightly higher than the outer jar.

All connections should be kept clean. Electricity can work wonders; but it has never yet been known to pass through dirt. Binding-screws show signs of corrosion after a period of work. They should therefore be examined occasionally, and filed when necessary, in order that good metallic contact may be maintained.

Connecting wires between the cells of a battery should be of a stout size, insulated, and wound into a spiral. This is easily accomplished by winding the lengths of wire round a lead pencil, and slipping off.

When it is required to connect wire to zinc plates, or cylinders, not furnished with binding-screws, the wire ought to be soldered to the zinc at its edge, using rosin as the flux, and the soldered part entirely covered with Brunswick black.

In joining ends of wires, the insulation ought to be stripped from the ends; the ends twisted together and soldered, and the insulation replaced.

To prevent "earth contact," *i.e.*, a leak of the current out of the battery into the earth, the cells should be placed on strips of glass, varnished with shellac varnish or Brunswick black. Should glass not be available, strips of well-seasoned wood will answer, provided they have been steeped for half an hour in melted paraffin wax.

The elements of a battery must not touch each other in any of the cells, as this would be completing the circuit *within* the battery. Elements should be at least half an inch apart. Whether porous cells be employed or not, this condition ought to be fulfilled.

—◆—  
A COMPOSITION FOR IMITATION OF IVORY, for decorative purposes, is made by gently boiling half an ounce of isinglass in a half-pint of water till dissolved, then straining and adding flake white (basic nitrate of bismuth and a very little Naples yellow, oxide of lead, and antimony). This is to be mixed with rice water and starch powder. Add to the work a final coat, and rub this with fine sandpaper to take off the gloss.—  
*The Builder and Woodworker.*

## AN EASY AND EFFICACIOUS METHOD OF MAKING TELESCOPES.

By "EXPERIENCED AMATEUR."



THROUGH many years of amateur metal and wood working I had always considered optical instruments as entirely beyond the practical manufacture of any handicraftsman, except that of an expert who possessed an accurate screw-cutting lathe. Experience, however, has proved that with ordinary care a very useful and portable instrument can be constructed, for either use on the sea coast, yachting, and other terrestrial investigation, or for astronomical purposes. Whichever of the two instruments is decided upon, it is essential that the proper lenses should be purchased from Messrs. Lancaster, of Birmingham, or other reliable opticians, who will, on learning the class of telescope, supply the proper object and eye lenses. These should be temporarily attached, at right angles, to a short but straight stick of deal wood, or the edge of a truly planed plank. The eye-piece must then be moved until a focus is obtained upon some distant object. This will show the maximum length of the telescope when drawn out and in use. The tubes may, of course, be numerous, as in a brass fitted instrument, but in this one, not having the accurate lathe at hand for "chasing" fine screws, we must construct the telescope in two tubes, or if preferred, in three. The former is ample for an astronomical, and the latter quite sufficient for a terrestrial instrument. To make the tubes for either of these, procure a round roller, on which drapers' blinds or other fabrics have been wrapped. This mandrel must, of necessity, be equal to the diameter of the "object glass" or other lens the tube is ultimately to carry, and rather longer than the length of the largest tube required. A sheet of cartridge, or good tough brown paper, wider than the required length of the tube, should be damped and carefully pasted with a mixture of paste and hot glue, in about the proportion of ten parts of the former to one of the latter. Wrap the paper once round the roller or mandrel *before* applying the paste to the sheet, then slowly roll it up, working out from

the middle, to the edges, all bubbles and wrinkles. If carefully done, there will be no paste on the mandrel, which can thus be left in until the tube is dry; but to prevent accidental fastening, the mandrel should be passed up and down slightly, to insure its freedom from its covering. Allow this first sheet to harden for two days, and then apply a second and third in a similar manner, with, of course, the *whole* sheet wet with its plaster or paste. If each application is properly dry, the result will be a tube of, say,  $\frac{1}{8}$  inch thickness, extremely hard and rigid, with no chance of warping and cracking like wood, or "dinging" like brass or copper, and, withal, much lighter and more portable. The eye-piece tube, if an astronomical telescope, can be made in a similar manner, but for the last "lap" of cartridge paper, as of a cleaner and better appearance than brown. To fit the lenses in these tubes it is only necessary to either cut off the rough ends of the tubes with a sharp knife, keeping the cut *square* with the sides of the tube,

or placing them in an ordinary lathe, and "trueing" off the ends with a wood-turner's chisel. An inner tube for each of the above tubes must now be "rolled," until a tight fit is obtained; cut two rings off each of these smaller tubes, one an inch, the other  $\frac{1}{8}$  inch long. Glue the longer one within its outer tube, A, Fig. 1; when dry, place the lens against it, and glue the smaller or shorter ring outside it. The eye-piece will be better if covered with a piece of flat cardboard closely fitting into the tube; into which a small hole must be made, as at B, Fig. 2. When the tubes are complete, the one which slides into its larger and outer one must be covered with one fold of cap or tissue paper, and used as a

mandrel to construct the short intervening tube, in which it is to slide. This latter must have enough laps of paper until its outer diameter fits accurately within the larger tube in which it is to be placed. When quite hard and dry, glue it into its place, removing the cap paper, the absence of the latter permitting a free drawing or passage of the smaller tube, as at c, Fig. 3. The larger, or main tube, can be covered with dark-grained paper in imitation of Russia leather, and, if preferred, the outer tube may

be paper and the small one brass. By this combination it is not easy to detect *any* paper in the construction. If, however, the outer tube is finished by brass ends, all paper becomes invisible. The inside of the tubes should be coloured a "dead" or "flatted" black before finally fitting in the object lens. If the series of lenses supplied require, or are improved by, an internal diaphragm or stop, it is easy to apply one made of cardboard glued to a short *thin* internal tube. This stop and the object lens

ought to be placed in the tube loose, and the best possible definition obtained by moving the diaphragm up or down the tube before finally glueing both *in situ*. I have offered these suggestions from actual experience, and in both the before-mentioned sorts of instruments paper has taken the prominent place to great advantage. If any unforeseen difficulties should occur, I shall be glad, through the "Council" column of "Ours," to do my best to remove them.

A SUPERIOR POLISH for restoring the finish of furniture that has been dulled or marred is made by the admixture of three parts linseed oil with one of turpentine.

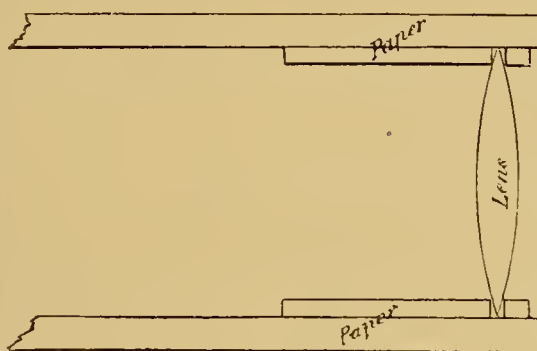


FIG. 1 Object lens mounted.

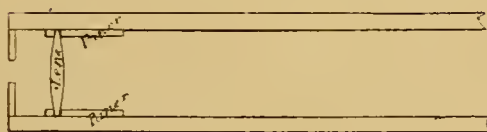


FIG. 2 Eye-piece mounted.



## SASH MAKING.

By FAUST.

## V.—FRENCH OR HINGED WINDOWS.



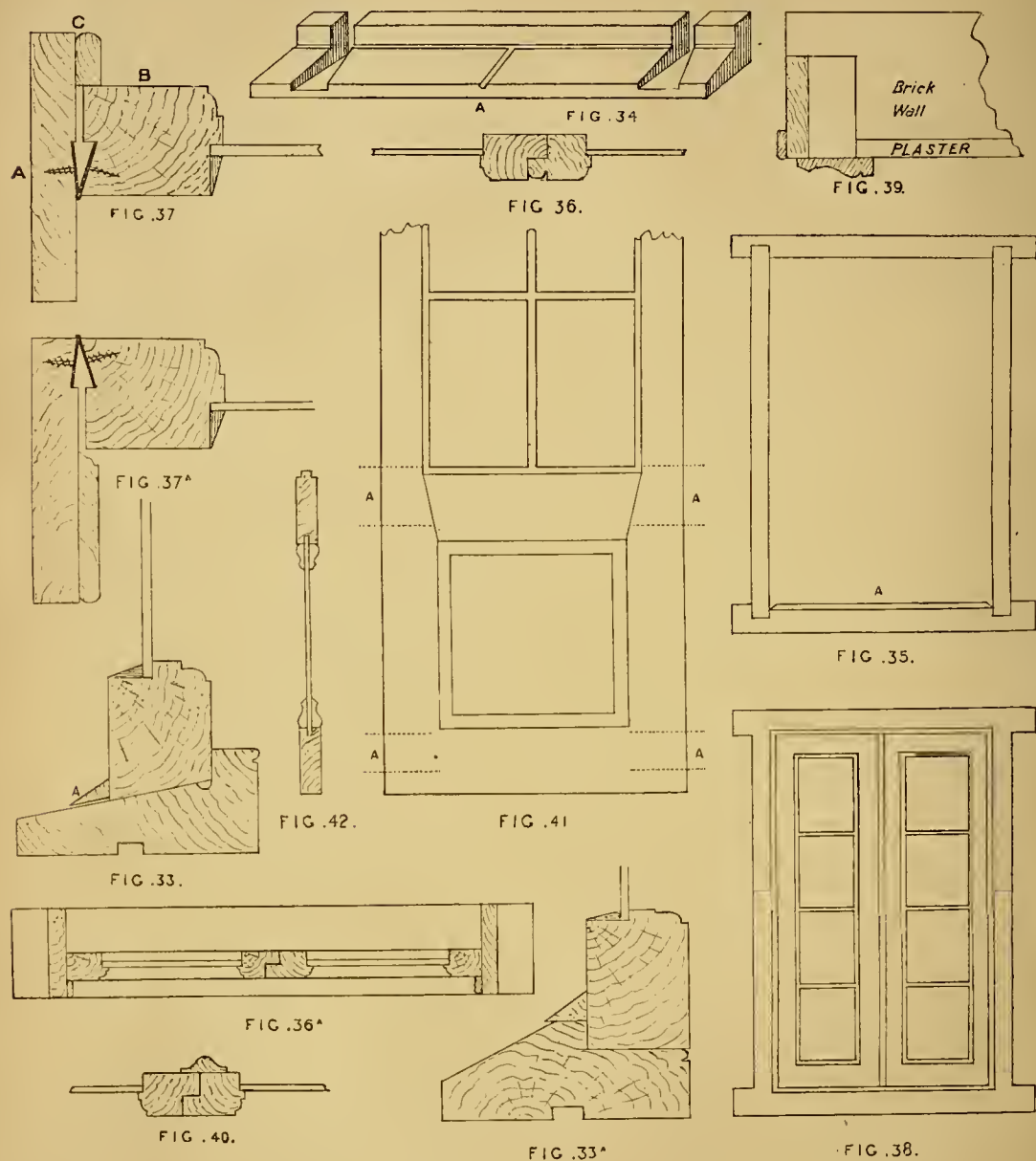
HINGED casement windows are not quite so popular in this country as on the Continent, one reason being that they are not so well suited to resist the weather, and keep out the wind and rain, as a hung window; still, in England, there are many places where they are popular, and they often serve a useful purpose in particular situations where hung windows would be too cumbrous, or where the thickness of the walls does not admit of a space sufficient for double hung sashes with their cases. They are also very useful as doors, when opening out into a garden, or on to a verandah, and their construction is much easier, and requires less wood than that of double hung sashes. We will suppose, for the sake of example, that we have a hinged window to make, such as would be suitable, say, for a small bedroom or other similar apartment, and that our "daylight" opening is 4 ft. by 2 ft. 6 inches. For this we will require the following material for the case, or framing: 1 sole, 3 ft. 2 in. by  $5\frac{3}{4}$  in. by  $2\frac{1}{2}$  in.; 1 lintel, 3 ft. 2 in. by  $5\frac{3}{4}$  in. by  $1\frac{1}{2}$  in.; 2 case stiles, 4 ft. 1 in. by  $5\frac{3}{4}$  in. by 1 in. The sole will have to be worked out to the section shown in Fig. 33, a hollow being worked along its length at the junction of the bevelled part with the flat portion of the cheek; this hollow is to catch any rain-water that may be driven up under the sash; a  $\frac{3}{4}$  inch groove should also be run on the under side of the sole, into which, when bedding the frame into place, the mortar will fix itself, and assist in keeping out wind and water. The stiles and lintel have simply to be planed up true on one side, the edges stripped, and gauged to the same width as the sole. To "set out" the case, measure off the width of the "daylight" of the window on the sole, keeping an equal length of stump at each end, then mark off the width of the groove to be cut to admit the end of the stile, giving allowance for the insertion of wedges, exactly in the same way as in the case of the sole of the cased window

described in the previous paper, and as shown in Fig. 34, leaving a thickness of 1 inch at the bottom of the groove. Cut the lintel in the same way, but make the grooves  $\frac{1}{2}$  inch deep. The stiles must now be cut to exactly 3 ft.  $11\frac{1}{2}$  inches. The case is then well nailed together with 3-inch nails, and wedges driven tightly into the grooves in the sole and lintel at the back of the stiles. The framing now presents the appearance shown in Fig. 35. The wood for the sashes should be of the same scantling as that used for the sashes of the hung window; and after preparation in the same way the stiles can be "set out," the length being taken from the underside of the lintel to that part of the sole where the outside of the sash comes to (see Fig. 33). For the size of the rails divide the width of the window into two equal parts, which in the job before us is 1 ft. 3 inches. Make each half of the window  $\frac{1}{2}$  inch wider, that is, 1 ft.  $3\frac{1}{2}$  inches, the extra half being to allow for the rabbet or check in the centre, as shown in Figs. 36 and 36A. The sash framing is mortised and tenoned, and checked and moulded, as already described. I have shown eight panes in the window, but that is a matter of style or convenience, and may be reduced or increased as desired. The window might also be made in one piece instead of two halves, as shown; but that also is a matter of taste or convenience, and the mode of construction is exactly the same for either style. After the sashes have been cramped together, and "cleaned off," they are fitted to the case, first carefully jointing and checking the two inner stiles, a  $\frac{2}{8}$  inch bead being run on the inside of the right hand sash to break the joint, and give a better appearance when the window is closed. Make as correct a fit of the sashes as possible, leaving of course sufficient space in the joints to allow for the painting, as upon the close fitting of this sort of window depends much of its weather-resisting capabilities. The hinges, of which there should be two on each sash, ought to be of brass— $3\frac{1}{2}$ -inch brass butts, they are usually called—and should be put on with brass screws. If iron hinges or screws are used they are certain to eventually cause trouble through rusting, especially the screws, which corrode in

and destroy the wood, and resist all efforts to remove them should a hinge want replacing. Brass hinges are a little more expensive to begin with, but in the end they are much cheaper to use. The method of fixing the hinges is shown in Fig. 37, in which *A* is the side of the frame, and *B* the stile of the sash. It will be noticed that the hinge is sunk into the stile considerably below the flush at the inner edge; this allows it to be a little open when the window is closed, and prevents binding from accumulation of paint or dust, or the head of a screw that may not be evenly put in. To fasten the window, a slip-bolt at top and bottom of the right-hand sash is required; these may be either flush bolts, or the ordinary kind, but they should be of brass, as also the centre bolt on the left-hand sash, which closes and holds that part in position. Pieces of  $\frac{5}{8}$  inch wood are now to be put round the inside of the framing, in the same way as the baton rods of a hung sash, a  $\frac{5}{8}$  inch bead being run on the edge, and mitred at the corners (*C*, Fig. 37), and into the bead run on the sole (*A*, Fig. 35). The window is now complete, and ready (after receiving a coat of priming paint) for putting in its place; a glance at Fig. 38 will show the appearance of the whole when finished. Fig. 39 shows how the joint of the plaster and case is finished with a moulding. A piece of wood of a shape similar to that at *A*, in Fig. 33, is a useful addition, as it serves to throw the rain-water on to the slope of the sole, thus allowing it to run to the outside of the wall. Any rain that may be driven by a strong wind under this piece of wood, will be caught in the groove that runs along the sole, and a small channel should be cut across the centre of the sole to allow of this groove draining itself; this will be seen at *A*, in Fig. 34. As circumstances often require that a window should be hinged so as to open inwards, I have shown the form of sole that must be used in that case in Fig. 1*A*, and the method of hinging and checking in Fig. 37*A*, a  $\frac{1}{4}$  inch bead should be run up the hinged edge of the sash stiles, and the hinges sunk almost flush with the bead.

The next and more important form of this kind of window is that used for the purpose of easy access to a garden or balcony. The

construction generally is the same as that of the smaller window, except, that as the opening is much larger, a stronger framing, both of case and sashes, is required; say for a window 7 feet high, let the stiles and lintel be of wood  $2\frac{1}{2}$  inches thick. The sole is much the same as before, but if possible of oak, or some other hard wood, as it is liable to be much trodden on, and so has a tendency to wear out quickly. The sashes also should be of heavier wood, say  $3\frac{1}{2}$  inches by  $2\frac{1}{2}$  inches; while, in order to more effectually keep out the weather, an additional check should be added, in the form of a raised bead or moulding, as in Fig. 40. The hinges should be  $4\frac{1}{2}$  inch edge butts, of which there must be three to each sash. Slip-bolts are used to fasten one half, but a lock or latch is generally put on the other half, to admit of securing the window better. When opening into a garden, panels are sometimes put in the lower part instead of glass; in that case a slight modification of the stiles of the sashes has to be made, which will become apparent by studying Fig. 41, in which the construction of the lower part of the sash is shown. The stiles must be one inch wider than for a glass window; the top of the middle or belt rail is about 3 feet from the floor; it is tenoned with a tapered shoulder, the taper being 1 inch, which inch is ripped off the upper portion of the stile, and checked and moulded in the usual way, working out with a chisel the few inches next the bevel where the planes cannot cut. The belt and bottom rail are 6 inches in width, and these as well as the lower part of the stiles have a  $\frac{5}{8}$ -in. groove,  $\frac{1}{2}$  in. deep, in the centre for the admission of the panel, which is inserted before cramping together, and is generally finished with a moulding on each side (see Fig. 42), or the ordinary sash moulding may be run on both sides of the framing, and mitred in the usual way. In cutting the tenons and mortices for the lower rails, allowance must be made for the panel grooves; the dotted lines at *A A* in Fig. 41 show this. Of course there are many styles and modifications of French windows prevailing in different localities, and to suit different circumstances, but the main details of all are the same,



## DESCRIPTION OF FIGURES.

FIG. 33.—SECTION OF SOLE FOR WINDOW OPENING OUTWARDS.

FIG. 33a.—SECTION OF SOLE FOR WINDOW OPENING INWARDS.

FIG. 34.—FINISHED SOLE, SHOWING GROOVES FOR STILES.

FIG. 35.—ELEVATION OF FRAMING.

FIG. 36.—SECTION OF CENTRE STILES OF SASH SHOWING JOINT.

FIG. 36a.—CROSS SECTION OF FRAMING AND SASHES.

FIG. 37.—MODE OF HINGING SASH TO OPEN OUTWARDS.

FIG. 37a.—MODE OF HINGING SASH TO OPEN INWARDS.

FIG. 38.—ELEVATION OF FINISHED WINDOW.

FIG. 39.—SECTION OF WALL AND FRAMING.

FIG. 40.—SECTION OF CENTRE STILES SHOWING ADDITIONAL BEAD.

FIG. 41.—ELEVATION OF LOWER PART OF PANELED SASH.

FIG. 42.—SECTION OF RAILS AND PANEL OF PANELED SASH.



and the amateur window maker can easily adapt the construction to suit his special requirements. The differences in thickness of walls may affect the width of the framing, or the necessity for opening the window inwards may cause the alteration of the checks and sole ; but these are minor matters, which a little thought before commencing the work will set right.

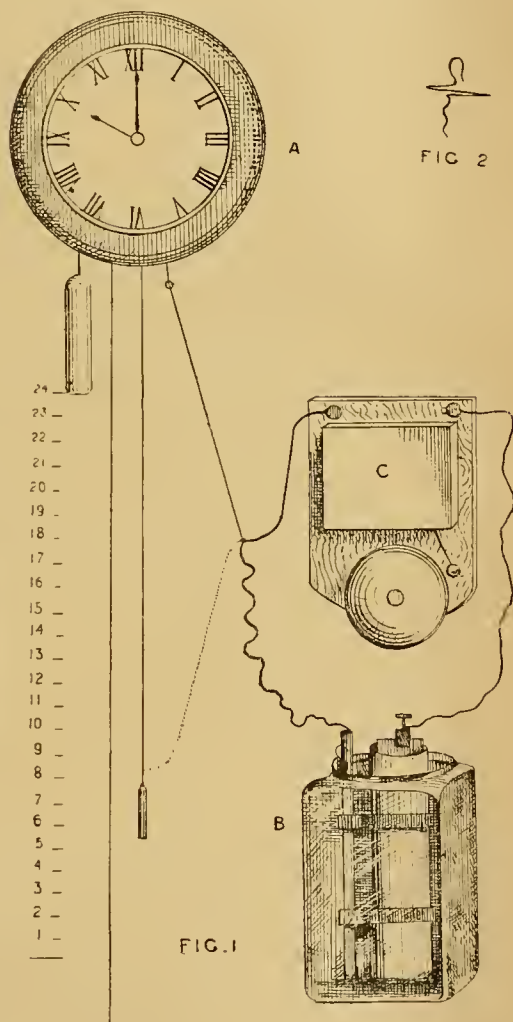
## HOW TO CONNECT AN ELECTRIC BELL TO A DUTCH ALARM CLOCK.

By ALFRED BEAN.

T is certainly not my desire, in describing the following simple method of connecting up an ordinary alarm clock with the electric bell, to disparage any of those more elaborate devices which are often used for that purpose. My only wish is to afford those who have not the opportunity or ability to fit up any of these rather delicate movements, a means of effecting their purpose in an easier and more expeditious manner, though at the risk, perhaps, of having my plans characterised by some as amateurish. Amateurish or not, however, so long as something useful, in whatever degree, may be attained, I feel myself justified in giving my readers the benefit. Its use will not, I think, be questioned when it is considered under what circumstances it will be of avail where any other system may not from any cause be used. Moreover, it may be adjusted without in any way interfering with the interior of the clock, the work being done by means of the weight alone. When it is also observed that not the smallest particle of technical knowledge is required, I think I have said enough to secure a hearing, at all events.

To many, no doubt, this will be unnecessary, the requisite information being gleaned by them from the annexed illustration, showing one form—which, of course, is not arbitrary, and may be modified at will—of the fitting up of the wire. In this sketch, **A** represents the clock, **B** the battery, and **C** the bell.

One pole of the battery is, of course, directly connected to a terminal of the bell by the wire *a*. To the other terminal, a short wire, having a ring of about half an inch diameter formed at one end, is secured, whilst affixed to the remaining pole is a suitable length of wire,



once attained. The only reason I may say for waiting until the alarm has nearly finished its course before connecting with the bell, is that—the alarm having usually a louder tone than the electric bell—it may have its share in arousing the sleeper in addition to its gentler but more importunate helpmate.

The above principle may also be applied, though, perhaps, with less accurate effect, to the draw-down cord of the moving weight of a clock. In this case a mark should be made on the wall or clock-case exactly opposite to the foot of the weight when fully wound up. Another line should then be made in the same way after twenty-four hours have elapsed. Divide the distance between these two marks into twenty-four parts, and number them from the bottom. All that then remains to be done is the winding up of the weight till the same number is reached as that of the hours intervening between the time present and that at which you require the alarm. For instance, suppose you set the clock at 10 p.m., and wish to be aroused at 4 a.m., you merely draw up the weight till No. 6 is reached, thus winding up the clock and setting the alarm at the same time.

## FITTING AND ERECTING.

By A FOREMAN PATTERN-MAKER.

### XV.—GEARING.



HE laying out of gear wheels is in some districts and shops an important section of the work of the fitter. It is so in many country shops, and in factories where fitters are kept to do repairs. It is also very serviceable to many amateurs. I will therefore devote one article to the briefest possible explanation of the principles and practice of this branch of work.

To ensure smooth running it is not sufficient to mark out a tooth that looks correct if judged simply by the eye. Nor is it sufficient, even if it were economical, to fit the teeth of one wheel to those of another, and cut away and modify their forms by a process of trial and error. There are methods by which, without any such

tentative processes, an accurate gear can be ensured at once, and these I will first explain in brief.

Although many forms of gear have been devised by mathematicians, there are only two which are adopted to any considerable extent in our shops, and only one which is in very general use. The involute form is used for some special purposes, but the cycloidal is employed for all that work of a general character in which wheels are required to work interchangeably with all other wheels—irrespective of diameter—of the same pitch.

All the teeth of interchangeable gears as at present constructed are made with cycloidal curves, or slight modifications of cycloidal curves, and they owe their value and simplicity of construction to this fundamental fact—that, taking the pitch lines of the wheels as base lines, if a uniform size of generating circle be used to describe cycloidal curves for the flanks and faces of teeth of all wheels of the same pitch, any or all of those wheels will gear correctly together; and the total action of the wheels will be the same as that of smooth peripheries rolling upon one another. Fig. 89 illustrates this.

Here *A* is the pitch circle, or base line of cycloid of a wheel, *B* that of a pinion, and *C* is a describing circle. Not only will the flanks (*D*) and faces (*E*) of these wheels, which are struck by *C*, as it rolls from the dotted to the full line position against the templet *F*, gear correctly, but also the flanks and faces of any other wheels of the same pitch, so struck, will gear together with absolute precision.

The principle once impressed upon the mind, its practical application becomes a matter of experience and judgment. Thus we soon find that it will not do to select a circle of any indefinite diameter at random; for if we do, we shall get some most undesirable and impracticable forms of teeth. If we take a circle of very large size, we sacrifice strength, because such a circle makes a very narrow root, rendering the teeth liable to fracture. If, on the contrary, we take a circle of small size, we obtain a broad root and increased strength, but a path of contact and line of pressure having,

on the whole, a higher angle of obliquity than is desirable. As a practical compromise or average, therefore, it is usual to select a describing circle whose diameter is equal to the radius of the smallest wheel of the set, and this strikes radial flanks for the smallest wheel; a weak form, it is true, but unavoidable if all the wheels are to be interchangeable. In engineers' pattern stores this wheel is usually taken as one of eleven or twelve teeth, few wheels in ordinary gears being made smaller than these. But as wheels increase in diameter the flanks become more spreading, and in the wheels of large size they are very strong.

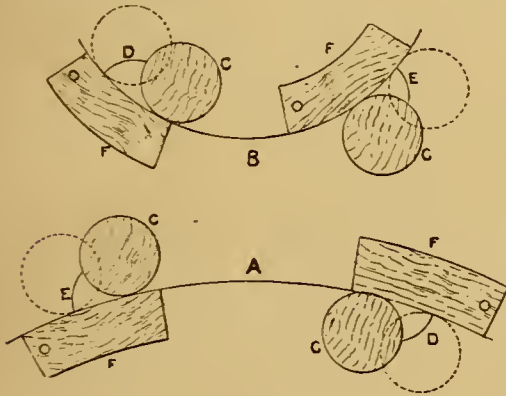


FIG. 89.

But in the case of bevel and mitre wheels, and in special spur gears, where the question of interchangeability does not come in at all, it is evident that any describing circle may be selected to secure the best results desirable for such special gears. In fact, two circles of different diameters may be chosen, if thought desirable—one for faces of wheel and flanks of pinion, the other for flanks of wheel and faces of pinion. This selection is often desirable in the case of bevel wheels, in order to avoid that weakening of the flanks of the pinion which would follow from the use of a small describing circle.

If, then, we have to strike out the teeth of gear wheels, we have to consider, first, the best forms desirable to give to those teeth, and then to select the generating circles accordingly. In the case of new sets of wheels, the circle is usually chosen in relation to the smallest wheel

of the set. In the case of teeth which have to gear with those of an old wheel or wheels, we have to find out by trial what striking circles would correspond with those forms of teeth, which is an easy task, and then we have simply to cut templets with convex and concave curves corresponding with the pitch circles of the wheel or wheels we want to try, and then roll generating circles of various diameters thereon until we light on that which generates the curves of the teeth of the old wheel, and that will be the circle which will strike the curves of the wheel teeth to work therein.

Having obtained a suitable generating circle, it is not necessary to mark out each tooth directly with it, as that would be a laborious operation; but having marked out one tooth correctly on a drawing-board, or on paper, all

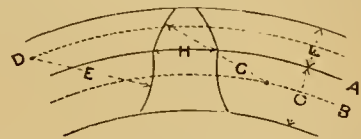


FIG. 90.

those on the wheel or pinion will be struck directly with compasses. Fig. 90 shows a tooth so struck. Here A is the pitch circle, B the line from which the tooth faces are struck with radius C, and D the line from which the tooth flanks are struck with radius E. The use of the lines B and D ensures symmetry in all the tooth forms.

Although it may be objected that the cycloid curve is one which cannot be struck mathematically correct to any one radius with compasses, yet for practical purposes such a method of striking is quite accurate enough. The difference between a true cycloid and the nearest radius adaptable thereto is so slight as to be almost imperceptible, and is not greater than the practical inaccuracies due to pattern making, moulding, or even machine cutting.

Of course, as these lines of centres and radii are simply adapted to the cycloid curves obtained by the generating circle, their positions and dimensions will vary in every different wheel and pinion, and the relations shown in Fig. 90 cannot be copied as being of a uniform or standard character.



But the distances,  $r$  and  $g$ , from the pitch circle to tooth point, and root, respectively, are standard. In all wheels of the same pitch these dimensions should be uniform. These proportions, as given by different authorities, and used by different firms, vary slightly. But proportions once accepted should be adhered to afterwards. A good rule, and one which I have always used, is  $r = 5\frac{1}{2}$  parts of the pitch, and  $g = 6\frac{1}{2}$  parts of the pitch;  $r$  is made less than  $g$  by the difference required for "bottom clearance." For the tooth thickness,  $h$ , Fig. 90, is taken as being equal to seven parts of the pitch, and this allows the necessary "flank clearance."

## FOUR DESIGNS FOR TURNERS:

AN INKSTAND, A CANDLESTICK, AND  
TWO UMBRELLA STANDS.

By ALEXANDER MARTIN.

(For Illustrations see Folding Sheet presented with this Part.)



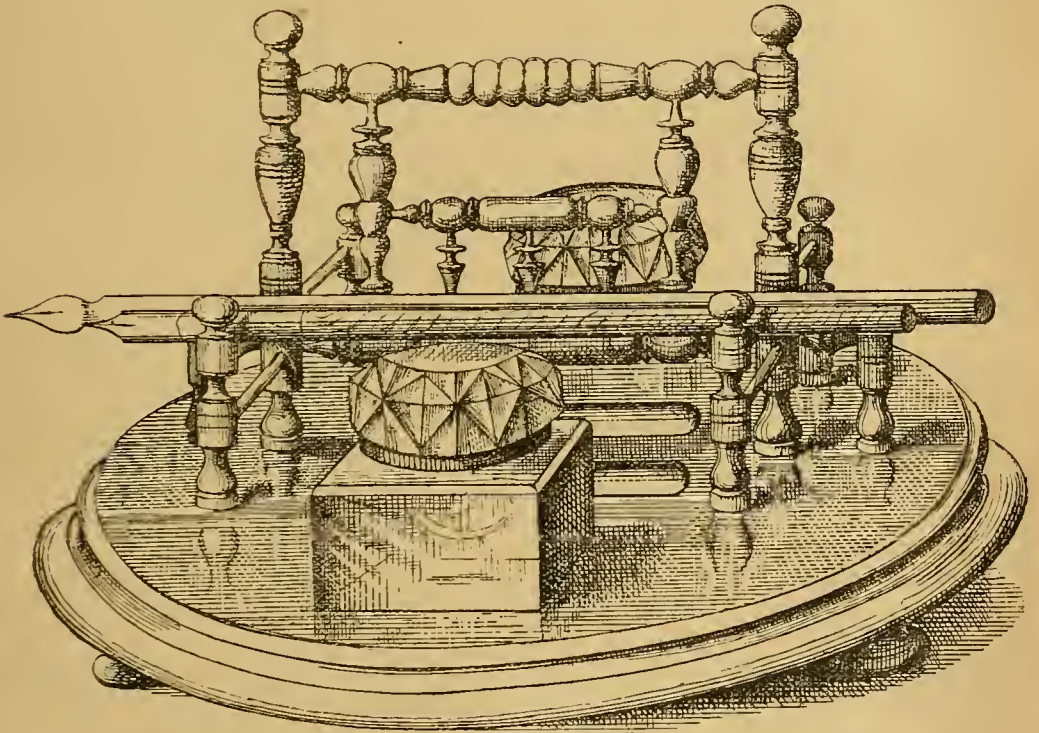
THE designs given in the Supplement this month are specially designed for production by the turning lathe, everything in them being done by that most useful machine—a machine to which the human race owes a great amount of the ornamentation meeting the eye at every turn. The articles in themselves are, first of all, useful; and after satisfying that requirement, several little ornamental details have been added, to lend some appearance over and above that attained by the various parts absolutely required. This is the fundamental principle which ought to regulate all ornament. "Ornament construction, and do not construct ornament," is a true maxim which may bear repetition more than once; for in these days there is such an extensive and widespread demand for ornamental things, that manufacturers are very apt to overlook the fact that an article may be so overloaded with ornament, or it may be so unhappily applied, as to become an eyesore to everyone with any taste. It is far better to have only a little ornament, and that little good, than have a great deal of it of questionable character. So much for the

morality of ornament; let us now proceed with the examination of the designs themselves. An inkstand is that shown first (see Figs. 1, 2, and 3), all drawn full size; the sketch underneath gives a better general idea of the finished article than the geometrical elevations do. It consists of a sole (see Fig. 1) 8 inches in diameter and  $\frac{5}{8}$ " thick, in which there are two square holes cut for square inkbottles. These, of course, must be cut square with a chisel, and they need only be made half an inch deep; or if they be cut through, a bottom piece, one-eighth of an inch thick, may be fastened on the under side of the sole. Two long shallow grooves are formed as shown; these are intended for spare pen points, wafers, paper fasteners, or any of the many little things one often needs when writing. The stand may perfectly well do without these hollows, however, if any difficulty is anticipated in cutting them. There are four little balls for feet on the under side of sole; their positions are indicated by the dotted circles near the outer edge, which is moulded as shown in Fig. 2. This Fig. 2 is the side elevation of the pen rack, and Fig. 3 gives the end elevation without the sole, which is omitted simply to save space. The long horizontal line in Fig. 3 is supposed to be the top of the sole, and the little turned posts show their pins projecting down into the sole. In Fig. 1 is shown the view of this pen rack looking at it from above, so with the three different views the size, etc., of every piece of wood required, is given. The two principal posts and the topmost bar are stouter than the rest, because they form, as it were, the framework proper, and are required to lift the whole inkstand about, the top bar being the handle, as no doubt every reader has already observed for himself. These posts therefore ought to go right through the sole, and be wedged on the under side. All the other little posts, rails, spindles, etc., require no explanation; they are so clearly shown in the drawings. By using great care with the members of each pillar, etc., keeping every bead and hollow crisp and sharp, especially when papering, a nice effect will be produced; but I need hardly urge the necessity of exercising an unusual amount of care, because every turner will see at once

that it is absolutely necessary for a successful issue.

An agreeable effect will be produced by using different woods; for example, suppose the three smallest spindles in the pen rack are of boxwood, or other wood of a light colour, the spindle at each side of these three, with the bar immediately over them and between these two, might be of rosewood, while the rest would be of ebony, or of wood stained black, with the sole black and

Our second article is a candlestick (see Fig. 4), drawn full size. The ornamentation consists here also in delicately wrought members, which should in this case be assisted by means of different woods, as shown in the figure. The brass socket and flange may be had from an ironmonger's, and it would be well to obtain it first, before turning, as the size might not exactly fit; the different pieces of wood should, of course, be turned with pins and sockets to fit tightly



PERSPECTIVE SKETCH OF INKSTAND, COMPLETE.

the four little feet of rosewood. This arrangement would be a pleasant variety, and emphasize the design. Of course other combinations may be made, this being merely a suggestion; but there is a substantial reason for making the sole black, because of the inkstains so likely to be left on it not showing on black as they would on any other colour. Then it is as well to have some black parts in the pen rack, otherwise it will not seem to have so close a connection with the black sole as it ought to have.

into each other, so that when all is together it will be like one solid piece. To give steadiness to the candlestick, a ring of lead is run into the sole on the underside. A dove-tailed groove is turned for the lead to be run into, as indicated by the dotted lines. Dotted lines are also shown in the upper surface of sole; but these indicate the line of turning, which at that part is lower than the edge of sole. If fluting of any kind could be executed, it might with advantage be used in the plain shafts; twisted flutes in the



upper half, and straight flutes in the lower half, form an exceedingly nice contrast.

The third article is an umbrella stand (see Figs. 5, 6, and 7, which are side, end, and top views respectively). These figures are all drawn to a scale of one-eighth of an inch to one inch, or one-eighth real size. From this it will be found to measure 2 feet long by 1 foot broad. The four posts measure 3 inches at their thickest parts; the rails at the top are  $1\frac{1}{4}$ " , the bottom ones  $1\frac{1}{2}$ " , and the spindles 1" in diameter; while the divisions (see Fig. 7) are  $\frac{3}{4}$  inch diameter. Every piece of wood used being round, the pan must be made with a large lip to catch the round bottom rail (see Fig. 8), which gives a section of rail and edge of pan. Any tinsmith could easily make a pan to suit this; as for the wood most suitable, any hard wood would do equally well unless, of course, it were wanted to match other furniture.

The last article is an umbrella stand, of a smaller size and a different shape from the previous one, and from its round form it will be the more easily put in any odd corner. The pillars (there are three of them) are of  $2\frac{1}{2}$  inch wood and 21 inches long over the shoulders; the upper rim is 12 inches in diameter, moulded on outer edge, as shown in Fig. 10, the inner corners being all rounded off; the bottom is  $12\frac{3}{4}$  inches in diameter, and moulded as shown in Fig. 11, where is also shown the bottom to receive the pan which rests inside. Underneath this bottom are three ball feet, and above the top rim are three knobs placed above the pillars. Such is the little round umbrella stand; it is small, but nevertheless will do its duty to the best of its capacity just as well as a larger and more pretentious article. Made of oak finished in its natural colour, it would be a quiet, chaste, little stand; and if the pan were painted a nice olive-green or terra-cotta colour, it would make a pleasing contrast with the wood.

A LACQUER FOR BRASSWORK may be made by dissolving 8 ounces of stick lac in half a gallon of alcohol. The solution, when filtered, forms a pale lacquer, which dries hard.

## HOW TO MAKE NETS.

By W. BUCHANAN.

### II.—A TENNIS NET.—FISHING AND TRAMMEL NETS.—DRESSING NETS.

 UR next will be a tennis net. This game has become universally popular, and many players may be glad to know how to make their own net; and many others, to whom expense is a consideration, would be able to enjoy the game more freely if they could provide themselves with a net at a trifling cost. This they will have no difficulty in doing if they have followed the instructions already given. After making a landing net, all straight ones are comparatively easy. They can all be made in the same way, from long fishing nets to short ones for any purpose, and the same instructions apply to all.

Suppose the tennis net is to be 3 feet wide, and 36 feet long, with a mesh  $1\frac{1}{2}$  inches square. Provide a mesh-stick  $1\frac{1}{2}$  inches wide, and a wooden needle, and a supply of suitable twine. There will be 24 meshes in the width, and the quantity of twine required may be calculated from that basis. Allowing a little for the knots, 600 yards should be an ample supply. This could be obtained, according to quality, at any price from 1s. to 2s. upwards.

Begin in the same way as the landing net was started, but instead of making a row of five, make a row of twenty-four loops; turn over and make the second row, and so on until the net is finished. Divide 36 feet by  $1\frac{1}{2}$  inches = 288 rows required to complete; probably less would do. The foot cord would have to be moved frequently in a net like this; it would therefore be more convenient to have it over a hook in the wall, or round anything that will bear the strain of knotting.

The time occupied in making this net would depend greatly on the dexterity of the netter. Two hundred stitches in an hour is not a difficult performance, and more can easily be done. Suppose the learner only does 150, or about six rows, it would take forty-eight hours to finish at that rate. By working at it during spare moments, if only for ten or fifteen



minutes at a time, the net would soon reach its destined length.

If a 2-inch mesh-stick is used, which would probably answer equally well, less time would be needed in proportion, and as the meshes would be larger, the net would be finished more quickly. About 400 yards twine and 30 hours' easy work should be sufficient. With a 2-inch stick there would only be eighteen loops in each row. A stout cord should be fastened along the top and bottom when finished.

*Fishing and Trammel Nets.*—Fishing nets are perhaps too large an undertaking for the amateur; but if he lives on the coast, and has opportunities of using them, there is nothing to prevent him making what he wants. In the colonies and remote regions where fish abound, the settler may find it an easy way of stocking his larder, or of adding to his income. If there are any local regulations about the size of mesh, the net would have to be made accordingly. First determine the length and depth of the net, and the size of mesh, and make it in the same way as a tennis net. If it is to be shot in a semicircle from the beach, and hauled ashore at both ends, the centre should be wider than the ends, to form a suitable bag for the fish; they are sometimes twice as wide in the centre as at the ends, and in making it stitches would be let out in proportion. All kinds are made very cheaply in factories, and except as a recreation it is hardly worth while doing them.

A trammel net is a very convenient one, and not difficult to work. It would be of great service to yachtsmen, colonists, and all dwellers by coast, lake, or river. It consists of three nets fastened together top and bottom. The two outside nets, or wallings, are made of stout twine, and a large mesh, 9 inches square, the centre one of soft twine, and a mesh  $1\frac{1}{2}$  inches square; the latter is twice the depth of the others, and hangs loose between them; fish coming up to it, pass through the first walling, and carry the loose net through the other, enclosing themselves in a pocket from which they cannot escape. The wallings would be made with a stick 9 inches wide, and about 5 feet deep, or seven meshes; the centre net with a

$1\frac{1}{2}$ -inch stick, and should be 10 feet deep. There should be a rope or stout cord along the top, with corks at regular intervals, and a bottom rope, with leads opposite the corks. The leads should be heavy enough to sink the corks, so that the net will stand upright on the bottom. It also requires a rope at each end long enough to reach the surface. Each rope has a weight at the bottom to keep the net in position, and a bundle of corks or float at the other end to mark it. It is sometimes used with only one walling, and set near the shore, or across the mouth of a small bay. By splashing and disturbing the water inside the fish are frightened, and darting outwards they strike the net and pocket themselves.

All fishing nets should be made of soft pliable twine specially manufactured for the purpose; it is sold at very moderate prices.

*Dressing Nets.*—A net having been made, it should be dressed with some preparation to preserve it. Fishing nets should have a dressing that will not harden the twine too much. Tanning with oak bark is the most common method; it is sometimes mixed with catechu, and sometimes the latter is used alone; the proportion depends on weight of the net; it must be dissolved by boiling, and the net immersed in the liquid. A practical fisherman would be the best guide as to details.

For tennis and landing nets, boiled linseed oil alone is a useful dressing, also boiled oil and copal varnish in equal quantities. The net is put in the mixture while warm, and allowed to remain all night, then dried, the superfluous dressing being removed with a rag; when dry it may get a second and even a third coat. Boiled oil and a lump of resin, used in the same way, is another. Boiled oil three parts, and gold size one part, are also used to preserve nets and lines; white rubber dissolved in turps is also good for the purpose.

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AN ALLOY of zinc 4 parts, tin 3 parts, and bismuth 1 part, is of a light silvery colour, with a brilliant crystalline surface, and is useful for casting small objects in plaster of Paris moulds.

## MODELS WORKED BY SAND.

By *ELECTRON*.

VARIOUS cardboard models may be worked by sand. Among these may be enumerated an acrobatic figure, windmill, watermill, seesaw, etc. The apparatus consists of a box of suitable size, in the upper portion of which is a hopper, which contains the

touching the models. A rebate should be run round the back edge  $\frac{3}{8}$  in. wide, for the back to fit in; the front of the box must be fixed 1 in. behind the groove for glass. Make a hopper, as shown, of thick cardboard, about 1 in. narrower than the inside of box, and glue strips of paper down the angles; cut a slit the width of inside of wheel, and  $\frac{1}{8}$  in. wide in the bottom of hopper. One end of hopper is kept  $1\frac{1}{2}$  in. below top of box, and a piece of cardboard the full width of

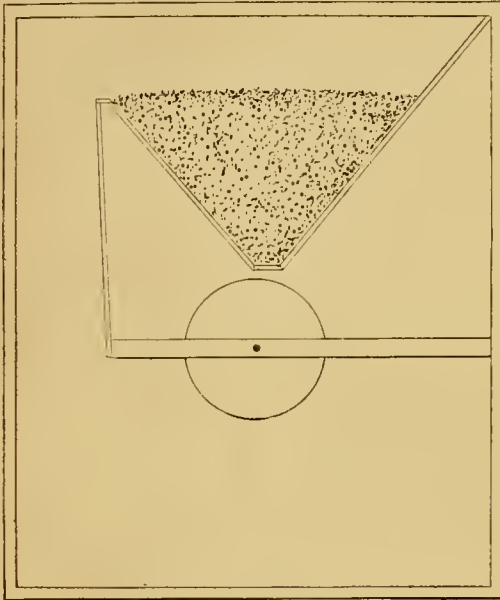


FIG. 1. Side Section of Box.

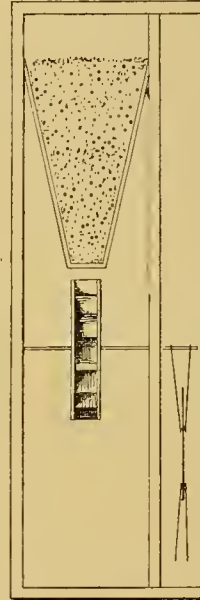


FIG. 2. End Section of Box

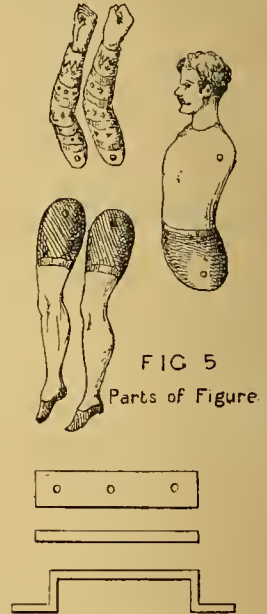


FIG. 4 Bearings.

sand; under this hopper is fixed a wheel, the edge of which is formed into compartments; into these the sand drops from the hopper, and by its weight causes the wheel to revolve. The axle of the wheel is carried through the front of the box, and the models are attached to it; when the sand has all run through the hopper, the box is turned three times on its edge, which carries the sand back into the hopper. Fig. 1 is a side sectional view of the box, and Fig. 2 an end section; the box is 12 in. high and 10 in. wide, the inside is  $2\frac{1}{2}$  in. deep, and the front 1 in. deep. The box may be made of  $\frac{3}{8}$  in. pine, the full width of sides may be 5 in.; a groove should be run round the front edge, in which a sheet of glass is fixed, to prevent anyone

box must be fixed down one side as far as the wheel, to form a channel by which the sand is run back into the hopper. The angles of the box inside, and the channel, should have strips of paper glued on them, to prevent the sand running through. The wheel is 3 in. in diameter outside, and 2 in. in diameter at the bottom of the compartments, and  $\frac{3}{4}$  in. wide. Cut out two discs of cardboard 3 in. diameter, and two more 2 in. diameter, glue the smaller discs in the larger, then cut a strip  $\frac{5}{8}$  in. wide, and glue it into a ring 2 in. diameter, and glue each end of the ring to the discs. The edge of the discs should be cut for the divisions, and they can be glued in, as shown on Fig. 3. The axle must be made of a piece of straight steel

wire  $\frac{1}{16}$  in. thick, and fixed exactly in the centre of the discs with sealing-wax. The bearings are made of thin sheet brass, of the form shown in Fig. 4, and two shoulders should be formed on the axle, to prevent its working out of the bearings. Half the back may be fixed in, and a cross-piece, as shown in Fig. 1, to fix the back bearing on. The front bearing is screwed to inside of front board, and the axle must be carried through front board, but must not touch it. After all the inside joints of box are papered over, the wheel may be fixed in its bearings, and the sand put in. The remaining half of the back may be fixed by screws, and the joints in it papered over on the outside. The wheel bearings are 5 in. from the bottom. The sand should be silver sand, put through a fine sieve, to take out all lumps and dirt. The glass at the front may be fixed with putty, or made to slide in and out.

If a figure is put on, it should be  $3\frac{3}{4}$  in. long, when the arms are above the head, the arms being  $1\frac{1}{2}$  in. long, and the legs  $1\frac{3}{4}$  in. long. The arms are fixed to the shoulders by a piece of fine wire turned up at each end, and the legs in the same manner. Fig 5 shows the parts of the figure. The arms must be attached to the axle about  $\frac{3}{4}$  in. apart, and made fast with sealing-wax. The figure is made of thin cardboard, and, if painted a light colour, should have a dark background; or painted dark, and a light background. It must be made as light as possible, so as to be easily carried round by the wheel.

If a wind or water mill is to be represented, it should be drawn on paper and fixed on the front, making the centre of sails, or mill wheel,

where the axle comes through. The sails or wheel are cut out of cardboard, a piece of cork glued on the back in the centre, and fixed on the end of axle. A fallen tree

may be drawn at one side, and a see-saw worked across it, by an axle brought through front board. The axle will be worked by a lever at the inside, connected to a small eccentric pulley on the axle of wheel, by a wire rod.

The outside of the box may be painted black, and marked on the back to show in what direction it is to be turned to get the

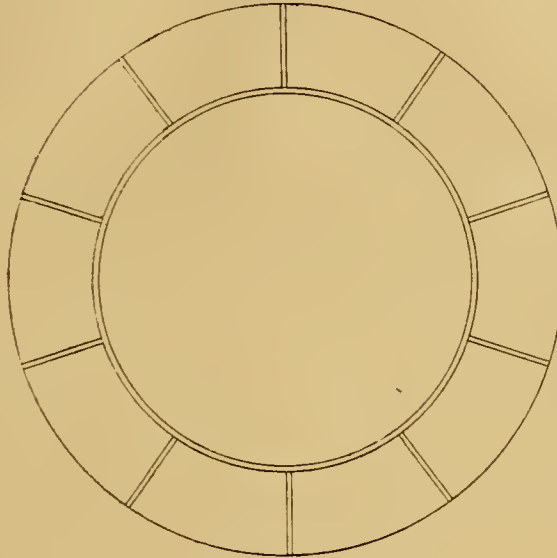


FIG 3.—SECTION OF WHEEL.

sand back into the hopper.

TO TRACE DRAWINGS.—If the paper upon which the tracing is to be made is soaked with benzine by means of a cotton pad, sopping it into the pores of the paper, the latter will become so transparent that the most delicate lines and tints may be seen more readily than through the finest tracing paper. Indian ink, water colours, or pencil take equally well upon paper thus treated, and last better than upon any other kind of tracing paper. Any kind of opaque drawing-paper in ordinary use may be employed for this purpose, stretched in the usual manner over the drawing to be traced. The benzine rapidly evaporates, and the paper resumes its original opaque appearance without showing the slightest trace of the process to which it has been subjected. When large pictures are to be traced, the benzine should only be applied to a part of the paper at a time, in accordance with the progress of the work.



## THE AMATEUR'S GARDEN: HOW TO MAKE IT PAY.

By J. H. E. J. HARRIS.

### I.



VAST amount of ink has been spent, argument has been wasted, and tempers have become heated on the subject of the Englishman's garden. There are those who hold that nothing can be grown at a profit on a small holding, such as the Irishman's "bit tatur ground," and that whether it be cabbages or new-laid eggs, cucumbers or strawberries, nothing is to show profit unless it come from a farm of hundreds of acres, where teams of horses and regiments of labourers have had a share in the cultivation. Everything must be done on a large scale, or some people are never satisfied. And yet, if there be one thing of which the Englishman is proud, it is his garden—the little patch of ground in the rear of the suburban semi-detached villa, one half devoted to neatly-arranged flower-beds, the other half to narrow and tortuous paths around and about those beds. Here is to be found in abundance the rose-bush, which would blossom were it not for the smoke and the fogs and the "blacks," the stunted evergreens planted by the jerry builder, that prowling cats may have some sort of nocturnal shelter, and various specimens of those hardy annuals which, doing their best under depressing circumstances and surroundings, show forth some of their gorgeous tints about once in every seven years. Many denizens of the suburbs affect a lawn in front of their villas. It is so nice and so respectable to be the possessor of a lawn, such a constant source of agitation and perturbation to see that it is properly kept by the itinerant gardener, who chops it with a scythe he has never learned to use, or runs it over with some antiquated lawn mower past the superannuation stage.

And yet how few of these good citizens reflect that *on every perch of ground they hold, a sack of potatoes may be grown!* For one tithe the labour spent in the cultivation of plants which seldom

flower, the potato may be grown with profit to the grower.

As these lines meet the eye, it is not too late this year for each villa resident to turn his plot of garden ground into a source of pleasure and gain, coupling these two strong incentives to work with the reflection that the cultivation of the soil is the natural and healthful occupation of man, that every square inch of soil should produce its share of food for the sustenance of the community, and that the more received from the land, so much the more is the burden of rent lightened.

To prepare the soil for potatoes, dig the land over lightly and *roughly* with a four-pronged fork. In this primary work most amateurs make two cardinal errors: Firstly, they dig with a spade, and land can no more be lightly and roughly broken up with a spade than can a haunch of venison be properly carved with a dessert knife. The spade *cuts* out the earth in heavy shapes, the fork *breaks* it up in light masses. The second mistake of the amateur consists in making his work look smooth and pretty to the eye. When he digs, he breaks up the soil as finely as possible, rakes it all over with a rake, and contemplates the smooth expanse of freshly delved earth with the highest satisfaction. With the first shower of rain this land "pans," and after the little puddles on it have dried up, the soil settles down with a smooth and hard crust, excluding air and warmth to the crops beneath its surface. Choose a fine day for forking and turning the land up in light masses, let it lie for a few hours to dry, then, with the fork, knock the soil to pieces, and with a potato hoe (a two-pronged hoe) strike the furrow or furrows for the tubers, two feet apart in the rows, and about eight inches deep. Plant the tubers six inches apart, and, striding the furrows, rake the soil from right and left over the seeds till the surface of the furrow stands slightly higher than the rest of the ground. Properly done, this ground should lie in a light "nubbly" condition, so that air and heat can penetrate to the seeds below. In planting, every two or three feet a broad bean may be dropped in with the potatoes, thus gaining two crops from the same ground. After the

tubers have been sown about a fortnight, again bestride the furrow, and very lightly lift the soil about three inches deep on each side of it with the fork; this warms the seeds, and hastens growth.

As to seed, do not select those wonderful fancy varieties which sell for fancy prices, and crop with fancy result. At present writing there is no safer late variety than the *Magnum Bonum*, or the *Beauty of Hebron*; these may be obtained true to name from such firms as Carters', Daniels', or Sutton's; while the pages of the *Kentish Express* teem with advertisements from farmers who have these potatoes on sale. And in the purchase of seeds generally, the amateur cannot be too cautious that *old* seed be not sold him, to his serious disappointment and loss. Some houses have a reputation to lose; they are, consequently, safest to deal with, and most convenient when the parcel post is the medium of interchange.

Between each furrow may be planted lettuce or cabbage plants, two feet apart; while round the fences or garden walls may be sown runner beans, red and white alternately, or peas, in some situations not too confined. "*Harrison's Glory*" are very fine croppers; these give a most pleasing effect to the eye, and a most grateful and appetising one to the body.

The refuse water from the house, instead of being wasted down the sewers, may be beneficially used in watering the garden; next to stable manure, nothing is more enriching to the earth than soapy water.

With the permission of the Editor, it is hoped to supplement this article by another, for the consideration of those who hold land from a quarter of an acre upwards; and if these remarks lead but a few amongst us to depend for some portion of their life's sustenance upon their own labour on their own land, we shall day by day the less merit the sneer that we depend so largely upon the foreigner for our food. He can export with profit, and yet, country for country, the advantages are about equal. Surely there is something wrong when a nation does not grow its own supply of potatoes.

(To be continued.)

## PHOTOGRAPHIC PRINTING PROCESSES.

By A PRINTER.

II.—SENSITIZED PAPERS READY FOR PRINTING—HOW TO CUT THE PAPER TO THE BEST ADVANTAGE—PAPER BADLY PACKED—ANOTHER METHOD OF CUTTING THE PAPER — "READY-CUT" PAPER — MATT SURFACE PAPER—PAPER - CUTTING MACHINE FOR CUTTING PAPER TO SIZES.



ALTHOUGH I have given concise, but practical, directions for preparing and sensitizing the paper ready for printing, there are many I know who prefer to obtain the ready-prepared article, and would like to know of a few brands of paper which give reliable, uniform, and brilliant prints. Now, there are so many brands of paper at present in the market, and the competition is so keen, with the only natural results of "cutting" prices, that I need hardly say that much rubbish is being offered to the public, and which, I am sorry to say, seems to be greedily purchased by the novice and the unwary. Cheap papers are always dear, because they fail to yield artistic and satisfactory results; and my readers, in considering the present-day charges for albumenized papers, must remember that the manufacturers of these have lately raised the prices somewhat,\* so they must not expect to get a good paper, rich in silver and of good printing and toning qualities, for 8d. or 9d. per single sheet, or 12s. 6d. per quire. But should wholesale prices fall again, a fair paper can and should be sold for this money. I have found a lot of this cheap ready sensitized paper so weak in silver that it has taken days to get a single print, and so full of acid that it has taken hours instead of minutes to tone. The very best policy to pursue is to buy paper of a good and well-known brand, and I trust those who scan these remarks will follow this humble piece of advice. I will, on my side, assist them to do so by naming a few trustworthy papers which can be used with the greatest confidence, and with every prospect of success. Probably, the most useful sensitized paper for amateurs to use, and the easiest to

\* It has risen in price about 10 per cent.—Ed.



tone, is that turned out by Messrs. B. J. Edwards and Co., The Grove, Hackney, E.; it is very rich in silver, and consequently quick in printing, whilst it tones with much less gold than most brands, and the prints are very permanent. This paper is known as the X L sensitive paper, and a sample sheet with illustrations may be had post free for 1s. Messrs. F. W. Verel and Co., Cathcart, Glasgow, also sell a good paper noted for its uniformity and brilliancy of results. Blanchard's durable sensitized paper is another good brand, and very free from blisters; a quarter quire costs 3s. 9d. post free, from Mr. Valentine Blanchard, 14, Findon Road, Shepherd's Bush, W. Messrs. Fourdrinier, Hunt, and Co.'s papers may always be relied upon; they have lately introduced a new variety, known as "Mucklow's new scentless albumenized paper," which they claim will print and tone quickly, is free from blisters, and will keep for two years. I have certainly obtained some excellent results with this paper, and it is a pleasure to use it. They also now sell a new matt surface paper, and will send samples of both free on application; their address is Dufferin Street, Bunhill Row, E.C.

Messrs. R. W. Thomas and Co., 10, Pall Mall, S.W., and Mawson and Swan, 33, Soho Square, W., both take great care in the preparation of their papers, and can both be recommended.

Having procured our paper, the next proceeding is to cut it up into whatever sizes we may require, and to the best advantage. With many amateurs it is not always possible to cut a sheet up into pieces of one size only, as their wants being often few and varied, it is frequently required to get two or three different sizes out of one sheet, say some cartes-de-visite, cabinets, and whole plates. I need hardly say that this operation requires a little careful thought, otherwise we shall not cut the paper without wasting a good portion of it; to obviate this, however, I intend to show by the aid of diagrams how a sheet of paper of the regulation size may be cut up in various ways with the least possible waste.

A sheet of paper measures about  $22 \times 18$  inches, and this will give, when cut up, no less than thirty-two quarter-plate pieces, or forty-two carte-de-visite size, as shown in the diagrams,

Figs. 1 and 2. The next size to these are cabinets, of which fifteen may be cut out of a sheet if divided as shown in Fig. 3. Twelve half-plates and four cartes-de-visite, or four whole plates, four half-plates and four cartes-de-visite may be obtained by folding the paper as shown in Fig. 4. It should here be noticed that one whole plate piece is nearly equal to two pieces of half-plate size, and this last method is a very handy one for cutting up a sheet to take a few trial prints from different size negatives. Fig. 5 will give six whole plates and three small pieces for quarter-plate pictures; instead of six whole, twelve half-plates may be obtained. Fig. 6 will give ten quarter-plates or cartes-de-visite and eight half-plates. I think these diagrams will prove sufficient for most workers; of course, when one comes to work larger sizes, such as those I now use,  $10 \times 8$  inches and  $12 \times 10$  inches, the negatives must be laid upon the back of the paper and the sizes planned out to the best advantage. It will, however, generally be found that the pieces left over will generally come in for some of the smaller sizes, although it may not be possible to work up the whole of the sheet to a nicety. Roughly speaking, I get four pieces  $10 \times 8$  inches out of a sheet, with several pieces suitable for gem or Victoria portraits, or two pieces  $12 \times 10$  inches and five pieces about  $5\frac{1}{2} \times 4\frac{1}{4}$ , suitable for  $5 \times 4$  views. To avoid reckless waste, therefore, I think I have shown that it requires a lot of "dodging and contriving," as the saying goes. A word of caution and advice is here necessary. Paper sent by post is generally packed on slight wooden rollers, and many dealers show great carelessness in cutting these off the proper length. Sometimes, therefore, the rollers are shorter than the paper, and consequently from a quarter to half an inch of the edges of the paper gets cracked and creased, and spoils this portion for use. I need hardly say that this causes much waste, as the sheet cannot cut up into its proper number of pieces, and should therefore be returned to sender as goods damaged through his own carelessness. Some paper, again, is very carelessly sensitized, the corners being allowed to miss entering the solution, and also full of pin-holes, etc., so it will be seen that such sheets cannot be cut up after



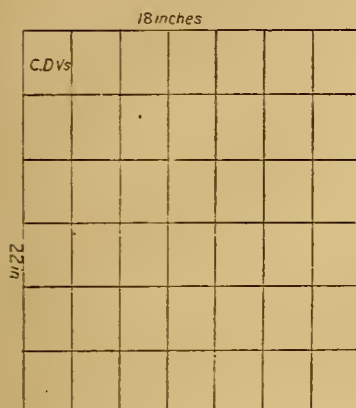


FIG. 1. 42 C.D.Vs



FIG. 2. 32 Quarter plate pieces

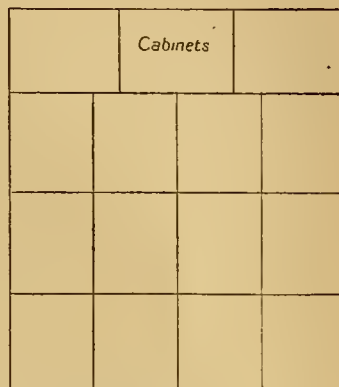


FIG. 3. 15 Cabinets

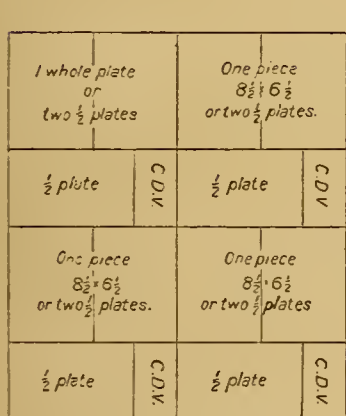


FIG. 4. 12 half plates, or 4 whole plates and 4 half plates, with 4 pieces left for C.D.Vs.

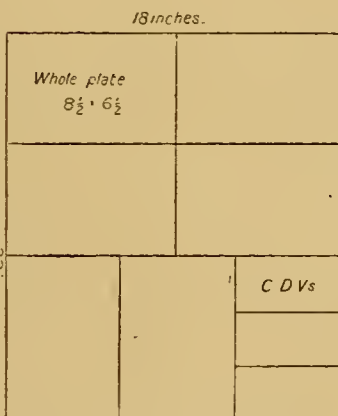


FIG. 5. 6 whole plate, and 3 quarter plate pieces.

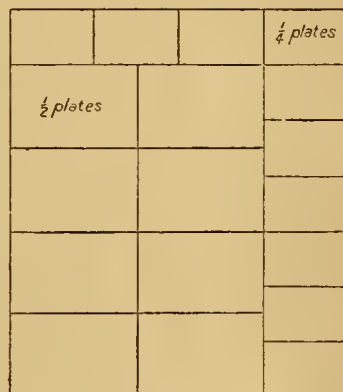


FIG. 6. 8 half plate, and 10 quarter plate pieces.

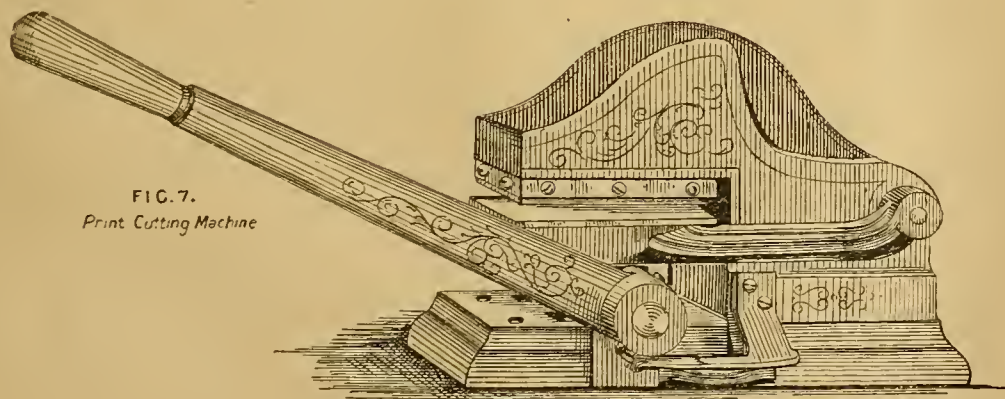


FIG. 7.  
Print Cutting Machine

the methods I have described in the diagrams, some of which require every bit of the paper to obtain the stated number of pieces. Most of them will, however, leave sufficient margin to enable every sheet of paper to be used to the fullest extent, if not too badly injured from the causes above stated. With regard to the manner of cutting the paper up, most workers fold it to the required sizes, and then cut it with a long sharp knife, such as a carving knife; but folding the paper in this way, unless very carefully done, is liable to crack the albumen, so I do not recommend it. It may be a very "old maidish" way which I adopt to cut the paper; nevertheless, I am not ashamed to tell my readers how I do it. I first lay a sheet of paper *face downwards* upon any clean surface (a large sheet of clean tissue-paper will do to lay it on), and hold it down by placing a glass paper weight at each corner. I keep by me pieces of cardboard of the exact sizes I am in the habit of cutting the paper into. These cardboard gauges are about an eighth of an inch larger all round than the glass-cutting shapes, no matter what size; but some leave a little more margin, according to how much waste space I have to spare. In planning out a sheet of paper for cutting up, I simply place the piece of cardboard on the back of the sheet of sensitized paper, at either corner, and run a lead pencil lightly round it. I then shift it across the paper, and proceed as before, and keep on till I have marked out the paper all over in this way. It is very quickly done, and the pencil is only run round three sides of the cardboard shape. A sheet of paper so marked out on its wrong side would have the same appearance as the diagrams given in this chapter, which may, in fact, be taken for the sheets ruled out ready for cutting. I then cut up with a large pair of scissors. Of course, if the sheet is to be cut up into various sizes, I use as many different sized shapes as I require sizes of paper, and I find these cardboard aids enable me to plan out a sheet of paper with the greatest possible speed and advantage. I must here point out that in cutting forty-two cartes-de-visite or fifteen cabinets out of a sheet of paper  $22 \times 17\frac{1}{2}$  inches, that they are cut to the exact size of the glass-cutting shape, and allow of no after

trimming. The cutting shape must therefore be laid on the whole sheet, and the several pieces neatly cut with the print trimming knife. A lot of time and trouble is, however, saved by buying the paper ready cut, especially in the smaller sizes, and for portrait work I procure all the paper I require in this way, which has one great advantage—it is machine-cut, and is all cut lengthways of the paper, which prevents, to a certain extent, distortion of the features by the stretching of the paper. Mr. Otto Schölzig, 31, Binfield Road, Clapham Road, S.W., makes a speciality of ready-cut papers, and his prices are very moderate for the good article he sells, viz.: 1-quire box, containing 1,032 cartes-de-visite, or 360 cabinets, 14s. 6d.;  $\frac{1}{4}$ -quire box, containing 258 cartes-de-visite, or 90 cabinets, 4s. 3d.; one sheet, cut into 43 cartes-de-visite, or 15 cabinets, or 25 pieces quarter-plate, or 10 pieces half-plate, 1s. post free. Mr. Schölzig also sells this paper per the 100 in all sizes, from quarter-plate up to  $15 \times 12$  inches, all *ready cut for mounting*. These ready-cut papers must be very carefully handled, especially when wet, as should the edges get only slightly torn, the print is irretrievably spoilt. Mr. C. C. Vevers, of 12, Market Street, Leeds, supplies all kinds of cutting knives for those who wish to cut up their own paper. The matt surface paper can now be had from all dealers, and also ready cut, at the same prices as mentioned above. For those who wish to cut their own paper by machine, either for private use or for sale, I give an illustration (Fig. 7) of a machine called the "Duplicating Print Cutter," for cutting out the paper before printing. By folding a sheet of paper to cabinet size, it will cut, with one stroke of the handle, fifteen pieces with perfect accuracy. Any size is made to order, with square or round corners, and oval or arch top. It is made by G. Eutrekin, 4384, Main Street, Manayunk, Phila., Pa., U.S.A., and may be ordered through any London house. Its price ranges from 25 to 40 dollars, according to size. In our next chapter we will consider the most suitable printing appliances, and the practice and theory of silver printing.

(To be continued.)

## SUCCESS AND FAILURE IN THE AMATEUR'S WORKSHOP.

By ED. C. ROE, Jun.

WANT OF SYSTEM—ILL-KEPT TOOLS—SHARPENING TOOLS  
—THE STATE OF THE BENCH-TOP—THE DISADVANTAGES  
OF PENCIL LINES—THE STRAIGHTEDGE AND  
SQUARE—THE GLUEPOT.



THE remark is often made by people who, at anyrate, profess to be authorities upon the subject, "Ah! anyone can see who has been at work here—an amateur." Now, why should this be so? A reason there must be; and in the following paragraphs we will discuss, and endeavour to elucidate, some of the points which are raised by this question.

One point which is doubtless of great importance is that fault met with very often with amateur workmen, namely, impatience. Now, this evil would doubtless be mitigated to a very great extent if amateurs would be more systematic. The want of system is often shown in the case of persons who, to save themselves the trouble of doing that most important thing, viz., setting out their work full size in section, struggle along, endeavouring to carry in their heads a multitude of dimensions, some of which are nearly certain to go astray; and thus when the work comes to be fixed together, an error is discovered which causes extra work for nothing, and consequently encourages impatience; besides, there is nothing like "first time," especially when connected with joiner's work. Set out your work full size, and then set out your lines on the material direct from the setting out; this is a golden maxim, and one which a professional workman cannot satisfactorily dispense with.

Another fruitful source of failure to produce neat workmanship, is the possession of faulty or ill-kept tools. A short time ago, the writer had occasion to visit the workshop of an enthusiastic amateur carpenter, and found there sufficient tools to gladden the heart of many a first-class joiner; but the condition which they were in was also sufficient to make the same heart quail. The planes were winding on the face or sole, the

back irons did not fit, the iron itself had been sharpened and sharpened until, in lieu of a perfect bevel, a wondrously beautiful series of curves had been formed, owing to improper and impatient sharpening. There were also a few gaps in the iron, doubtless caused by omitting to well brush the stuff before using, or carelessly putting down the planes on the bench after using. This would be prevented, to a very large degree, if a thin lath was tacked across the end of the bench at right angles to the way of the planes, on which to rest the front of the sole of the plane.

To resume our inspection, a brace is to be used, and the question naturally presents itself—Where are the bits? Ah! there they are, stuck in a piece of wood fixed to the wall, half of them in a state most terrible to behold; some of the centre-bits with the outer cutter sharpened away until shorter than the clearing cutter, owing to their having fallen down from their place on the shelf, butter-side downwards, or, in other words, on to the cutting edge. All these things would have been guarded against and prevented to a very great extent, had the bits been kept in a bag made for the purpose, from green baize, a long narrow pocket being provided for each bit. On the bench lays a chisel, of which complaint is made that with it a clean cross grain cut cannot be made—and why? Because it has not been ground thin enough; or if so, had, in the impatience of the worker, been held at too great an angle while sharpening, thus destroying all the benefits likely to be derived from grinding with long bevel.

Another fruitful source of inaccurate workmanship is the bench top. A good workman on a bad bench is at a loss until it is put into proper order, which state of things demands that the top shall be out of winding, and quite straight; therefore look to the bench-top often, as being, indeed, a very important item.

There is also a tendency on the part of some amateurs to work by pencil lines invariably. Now, in framing, and all work where shoulders are required to be cut, the lines should be set out with a cutting knife; in lieu of this, a penknife is just the thing, so that no excuse should be made on the score of absence of proper tools.



If such lines are used, there should be but little fitting required further than mitreing, except in hard wood, where the exigencies of the case demand more than ordinarily accurate fitting.

Oftentimes it is seen in amateur workshops that the square, straightedge, and winding strips are things regarded as more to be looked at than used, and are employed but sparingly when planing up stuff. It is most important that trials for inaccuracies be constantly made, and therefore the time occupied by such trials should not be deemed wasted, but rather so much gain to the job, as tending to afford a better and quicker finish.

To turn to another corner of the shop before mentioned, we observe a glue-pot partially filled with a composition all black and mouldy, and we are informed upon inquiry, with all the seriousness imaginable, that it is considered good glue; and when the question is put as to how many times this peculiar-looking substance has been melted, we are informed that it has only been so treated some eight or ten times, and at the same time we hear some disparaging remarks respecting the said glue, because it half failed to hold the work together when last used.

If we want good work when using glue as a means of uniting, we must have a good clean pot of glue well made, and to obtain this we should proceed as follows:—Take the glue, and after breaking up in fairly small portions, place it in water to soak for several hours, after which, take it out and fill the pot, which, if not copper, should be tinned inside, and add a sufficiency of water—how much will be found on trial, and placing on the fire with plenty of water in the outer compartment, let boil, stirring well at intervals; if too thick, thin out with hot water.

Never use mahogany or oak for stirring up glue; it tends to discolour same.

Our gossip has been of rather a rambling character, but we will hope that the few hints contained therein may have a beneficial effect, and cause a looking into of such little matters, small in themselves, but of vast importance to the amateur who really loves his hobby.

## HINTS ON WORKING HARDWOOD.

HE following may prove useful to those who have never worked hardwood. When nailing, never drive cut nails without first boring for them; wire nails, however, are best for the work, and if the wood be very hard, as heart ash or quartered oak, the point should be dipped in wax or soap. A very convenient grease box can be made by boring a  $\frac{3}{8}$ -inch hole in the haft of a hammer, and filling it up with wax or soap; it is always at hand, and not in the way.

When nailing in panel moulding never drive the nail so slanting that it will go into the panel, but keep it nearly parallel with the face of the panel, so that the nail will enter the edge of the stile rail. By driving it thus, it will hold the moulding on the frame; but if it goes into the panel, when the panel shrinks, the moulding will draw away from the edge, and likely split the panel.

Be sure there is no grease left on the face of the hammer after each nail is driven, because it is liable to bend the next nail.

The best way to make inside joints with hardwood is to scribe them; often the stuff is warped, and cutting a square joint only means fitting, which can be avoided by scribing the joint.

If it is compulsory to nail back a piece of very much twisted stuff, like hazel or sycamore, the mechanic should be very cautious, for kiln-dried timber is so brittle and non-elastic that it will not readily yield to strain, and will crack like glass.

The best plane to use on all hardwood is the iron plane, especially where the wood is curly or cross-grained. Dull tools may do fairly well on pine, but on hardwood they are useless, and keen edges are indispensable for clean work. A good iron block plane is also necessary; but I would recommend all cuts and mitres to be made direct from the saw.

A good workman will make his calculations carefully, and insure the certainty of his cut before making it, thus saving time, temper, and material.

# NOTES ON NOVELTIES.

By THE EDITOR.

**W**IREWORK. Messrs. Zilles & Co., 24 and 26, South Street, Finsbury, London, E.C. I have much pleasure in calling attention to some of the productions of this well-known firm. The Figs. are in accordance with Messrs. Zilles' catalogues, and the prices are given against each illustration.



FIG. 280.—3d.



FIG. 207.—3d.



FIG. 52.—3d.



FIG. 190.—3d.



FIG. 357.—3d.



FIG. 212.—3d.



FIG. 502.—3d.

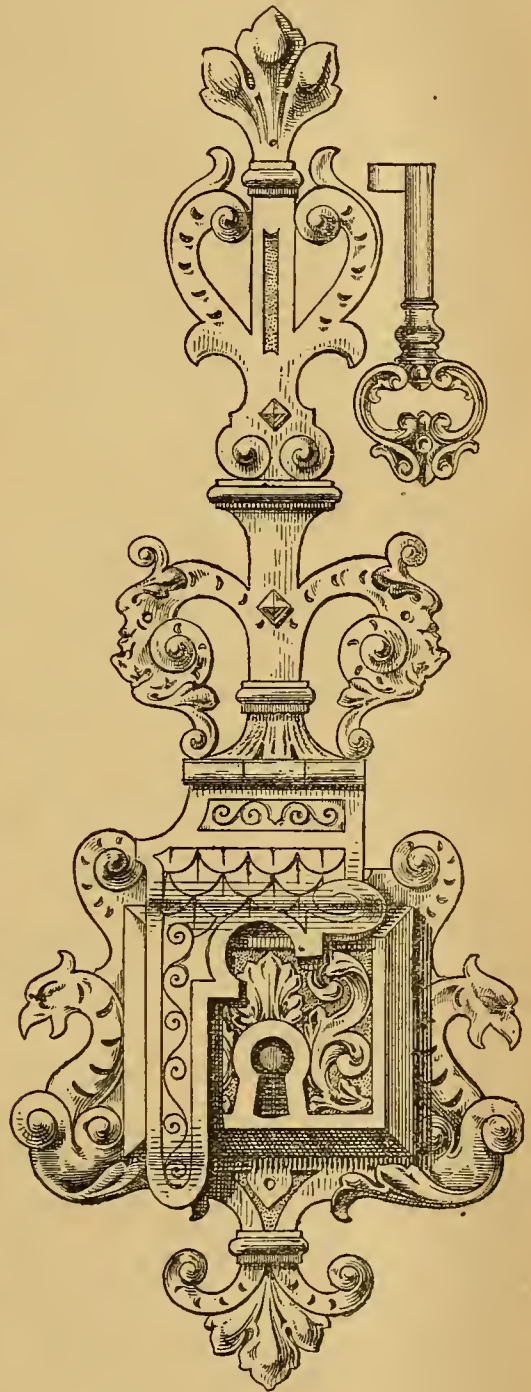


FIG. 77 $\frac{1}{2}$ .

7 in. long, 5s. 6 in. long, 4s. 6d.



## AMATEURS IN COUNCIL.

For "Instructions to Contributors and Correspondents," see p. 46 of this Vol., or Part 13 (New Series), p. 46.

### Self-acting Fountains.

THOMAS H. HARRISON writes:—"I was much pleased on receiving my AMATEUR WORK for December last, to find a description of a 'Self-acting Fountain,' having had a desire for some time to possess one of those articles. My pleasure was somewhat marred, however, by my inability to thoroughly understand the working of the same, owing to what I suppose must be printer's errors. I waited several months hoping to see them corrected in 'Amateurs in Council,' but have seen only one so far, viz., size of pillar. A week or two ago I started to make one, thinking that would probably solve the mystery. I am glad to say it has turned out a perfect success, and is much admired by my friends. I venture to point out what puzzled me, and what may be keeping some fellow-amateurs from attempting the work. On page 28, first column, the small cone is referred to as 'B, Fig. 5,' but in second column as 'K.' Bottom of first column, water is 'poured into the basin F,' but top of second column it is 'poured into basin A.' It is marked 'F' in diagram. Bottom of first column, and twice in second, the top vessel is called 'P,' but is marked 'A' in diagram, a little further down it becomes 'D,' without loss of compression to the surface of the water in 'D,' and further on still it becomes 'A.'

"Perhaps the reversible action of the fountain has something to do with the mixing of the letters, but it certainly did not help me to understand the working of the fountain. I might add that my fountain only played about twelve minutes at first, but by contracting the opening of the nozzle it now plays fully twenty minutes."

### Bookbinding Tools.

H. B., 50, Lord Street, Jarrow-on-Tyne, writes:—"I was extremely pleased to see the article on 'Home-made Tools for Lettering and Finishing Books,' in the June part of AMATEUR WORK. I have often wondered if some-

thing could not be done in that line; and to prove the truth of the oft-quoted adage, 'There is nothing new under the sun,' I was passing a pawnshop yesterday, and saw something in the window that looked like bookbinding rolls, but I thought they seemed very coppery, so I went in to have a look at them; there were three of them, one all brass, a plain three-liner , the other two were brass bodies with a copper rim soldered on. They had to all appearance been electrotyped, then bent into a circle and soldered on. I could not help thinking of the article in 'ours.' One of them is like Fig. 1,



the other like Fig. 2, each one in a separate brass holder in a rosewood handle. I got the three for 2s. 3d. I thought they were not dear at that. But in using electrotyped letters and ornaments, is there not a fear of the solder melting? I suppose one will have



to be very careful, and not overheat them. I would like to correspond with some amateur bookbinder with a view to mutual help, as I have two small founts of printer's fancy type, some of which I would be happy to lend for electrotyping, in exchange for other, as I am afraid printers would not be very ready to lend type to be copied from."

[The writer of the article in question hails from America. As soon as he sees your letter he will no doubt let us have his opinion. In the meanwhile you may rest content that you have got a bargain.—Ed.]

### Gas Engine Making.

CRACK.—The paragraph you refer to was on page 143 of the present Volume, wherein I promised several correspondents that the subject of gas engine construction should be dealt with in AMATEUR WORK. I hope to find space for these articles in the next Volume, but I am not yet in a position to give a definite promise.

### Transferring Fretwork Designs.

GEO. POTCHETT writes:—"I am much interested in the fretwork designs in AMATEUR WORK, but do not quite know how to transfer the pattern to paper, as tracing with carbon paper, which is the method I generally employ with ordinary designs, would spoil the pattern, and this would be a pity. Perhaps some of your numerous readers would give me a few hints on the subject."

[I know one or two amateur workers interested in fretwork who always invest sixpence in an extra copy of AMATEUR WORK when they wish to cut a design; they say that it saves them sixpennyworth of trouble in tracing. If this suggestion does not meet with your approval, you will find that by taking a tracing on tracing-paper with aniline ink, and putting it down on a graph, you can in a few minutes pull off as many copies as you can possibly require.—Ed.]

### Address Wanted.

S. M. LLOYN (*Goderich, Canada*) writes:—"A friend of mine sent a P. O. order for a small amount to Mr. A. A. Dorrington, of West Gorton, Manchester, some months ago; so far he has heard nothing, and is at a loss what to do. Can you tell me if Dorrington is still in existence? I fancy he must be, or the letter would have been returned long ago. Hoping to hear from you favourably, and if possible with A. A. D.'s latest address."

[I have not lately heard of Mr. Dorrington, but he will probably see this, and write. The article required may have been sent off, and has miscarried in the post.—En.]

### Bleaching Dark Wood.

V. DENT.—"I do not think it would be possible to bleach teak to the tint of light oak, but you might try a solution of oxalic acid, which is often used as a bleach by French polishers. I am afraid you would find the veneering process you mention more trouble than it is worth. As a rule, veneers will not stand in a warm damp climate; but a good deal depends on the way the work is done. I have known veneered furniture stand well in India; but it may almost be said that the exception proves the rule that glue is very perishable in a damp climate."—D. A.



### The Expense of Photography.

Co. CAVAN writes:—"I am surprised at you for letting such an article as the one written by 'A Printer,' in June part of *AMATEUR WORK*, through your hands without saying something, and without seeing at a glance that the writer must know very little about amateur photography; either that, or he is one of those who would keep, if he could, photography, like lots of other things, a trade secret. But I am certain amateurs will not be led far by him. Thousands can speak for its simplicity, and I think in a magazine like ours, where help is wanted, an article like this should have no place, True, he confesses he failed in every branch, and many times over, and that he shudders to think of the monstrosities he turned out; quite true, I am sure; and still he would take on to write chapters in *AMATEUR WORK* on the very same subject. Well, I do not think any amateur wants to hear much from him; the amateur we want to hear is the one who can take a good photo, and who made his own apparatus, etc. 'A Printer' also says, if anyone wish to become a photographer he must give up every other hobby, for if he wishes to turn out decent work, it will take up the whole of his spare time, and considerably more than his spare cash; but I could tell amateurs that when they buy materials in quantities, they can take negatives for twopence each, and prints for one penny each. Where, now, is the cost? I can see plenty of young men smoking cigars costing sixpence, and others taking a glass of brandy at sixpence; and you will never hear the cigar maker nor the distiller calling this 'never ending expense'; and yet our writer here says photography will take more than an amateur's spare cash. Now, Mr. Editor, whether would an amateur have more pleasure and profit in drinking a glass of brandy and smoking a cigar, or in taking three negatives and six prints? The two will cost just the same money, and I think you will say with me that the photograph is far the best. If I had seen this chapter by 'A Printer' when I was beginning to make my camera, tripod stand, etc., just think what effect it would have had upon me. Why, I

should have given up the thing for ever; but I did not see such a chapter, and am thankful I did not. I know amateurs who, with the help of instructions out of *AMATEUR WORK*, and Messrs. Lancaster's little book entitled 'A Photograph, and how to take it,' have made their own apparatus, and who can turn out work equal to any coming from our big cities; so that I think 'A Printer's' chapters will serve no good purpose, but rather tend to discourage amateurs."

[I can assure you that "A Printer" understands the subject on which he has undertaken to write; but the question of expense is one on which there may be many opinions; what one man can do for a few pence another will spend shillings over. It would be interesting to have some varied opinions upon the point. Amateur photographers will please come forward!—Ed.]

### American Organ.

A. O. B.—As I have before pointed out, in reply to a similar query, it is impossible to add extra sets of reeds to the instrument when once the reed board has been purchased; therefore the full number of sets required *must* be decided at the commencement of the work. If only one row be wanted, it should be, of course, of 8 ft. tone; if two rows, then one of 8 ft. and one of 4 ft. pitch. In the latter case, the position on the reed board would be the 4 ft. row in front, and 8 ft. at the rear. If three sets are decided upon, the specification will be found in the present articles, Chap. 1.—THOS. L. WINNETT.

### Dimensions of Vertical Boiler.

A. WESTON writes:—"I should be very glad if 'Electron' would kindly state dimensions, thickness of copper, and steam pressure it would require to build a vertical boiler similar to that described by him on page 80 of *AMATEUR WORK*, but to drive a cylinder of an engine  $1\frac{1}{2}$  inches bore."

"Make the boiler 10 in. diameter and 20 in. high, fire-box  $7\frac{1}{2}$  in. diameter and 9 in. high, smoke tube  $2\frac{1}{2}$  in. diameter. Shell of No. 18 sheet copper, and crowns of No. 28 copper. Pressure 20 to 25 pounds per square inch."—ELECTRON.

### Stops for Harmonium.

FRANK TREMLETT.—To fully and clearly explain the mechanism of the expression, sordine, celeste, and tremolo stops for an harmonium having a single row of reeds, would, I regret, take up more space than it is possible to devote in these columns. Indeed, it is practically impossible to adapt this number of stops to an harmonium without provision having been made for them during the construction of the instrument; and hence it is needless for me to state that it is also impossible (even if thought of previously) to fit so small an instrument as the portable harmonium described in Vol. I. of the present series of this magazine, with these stops. You might, perhaps, with a good deal of trouble be able to fit it with a forte stop, though I fear it would prove but labour in vain.—E. A. S.

### Cement.

ERNEST WILLOUGHBY.—I soaked the sample of cement which you sent me, in hot water for eight hours, and at the end of that time it showed no sign of dissolving. I think we may safely conclude, therefore, that it is waterproof. It does not appear to have occurred to you that the cement must be used when first made, and before it has had time to set. If it would redissolve after having once become hard, it would not be a waterproof cement. The action of bichromate upon gelatine is to cause it to become insoluble after exposure to light. The chemist you mention should have known and explained this to you.

### Canvas Boat or Canoe.

P. L. BERTIN (*Old Windsor*).—You will find very full instructions for making a canvas boat in the May part of the present Volume. These instructions are supplemented by a sheet of working drawings to scale. If after a careful perusal of these you still find anything that requires further explanation, by sending me particulars of your difficulty you can avail yourself of the services of Captain Antony Weale, of *Liverpool*, a gentleman of great experience, who has kindly consented to advise readers of *AMATEUR WORK* on nautical matters. If after this you do not make a first-class boat, it will not be the fault of *AMATEUR WORK*.

### Speed Gearing for Lathe.

E. J. SMITH writes in reply to C. J. WOLFE.—“I have pleasure in giving my opinion of the speed gearing for lathe, illustrated on page 334, by Mr. Wolfe, and I consider that as a method of decreasing the speed, and thus taking the place of the ordinary noisy back gear, it is a simple, effective, and efficient contrivance; the only objection that, to my mind, could be urged against it is that the strap from the countershaft to the mandrel must necessarily be very short, and this ought to produce friction, and cause the motion to, as it were, drag. But as a means of gaining speed, I fear that the objection named before would be much more apparent, and this, together with the high speed of the mandrel, unless the diameter of the bearings of this latter are very much less than is usual, will, I fear, cause it to be rather heavy work; but if the bearings of the mandrel are long, and of moderate diameter, and parallel, and well fitted into their bearings, and well oiled, it should be a success. I may illustrate shortly a method I rigged up for quick speed for wood turning, with the Editor's permission.”

### Shoemakers' Wax.

B. A. Y.—This is made by melting the best Swedish pitch and tallow together in a vessel over the fire; the quantity of tallow must be found by experiment, as when the pitch is new it requires less than when it is old. After being melted it is rolled into balls, and kept in cold water. The ordinary black pitch is not suitable; you can tell the proper kind by its being of a brown colour when fractured, and a piece held in the hand a short time becomes sticky.—ELECTRON.

### Telephone Carbon Transmitter.

S. L. W. (*Plymouth*).—The telephone carbon transmitter described and illustrated on pp. 142-3, Vol. IV. AMATEUR WORK, Old Series, was not my invention. The description was transcribed from a communication kindly lent by an electrician of some repute. A diaphragm of pine shaving was chosen as being a resonant material superior to many others. The thin diaphragm may be made without much difficulty by reducing down a thicker piece with plane

and glass-paper. There need be no great difficulty in getting it uniformly thin if such a gauge as a pair of callipers is used to test the thickness. Of course, success will depend upon an exercise of care, time, and patience. You may try parchment or any similar membrane, if you can ensure it being uniformly stretched over the mouthpiece of the instrument, and can get the chip of carbon with its connecting wire firmly glued to the membrane. There would be no harm in trying ferrotype plate. If you try these things, kindly let us know the result for the benefit of others.—G. E.

### Spring Motor.

W. C. writes:—“As advised by H. Smith (p. 288), I wrote to Mr. W. Tunbridge, enquiring about a spring for motor, and enclosed a stamped addressed envelope for reply, but I have not received any communication from him. As it is now a month since I wrote to him, I begin to think that Mr. T. may be another of those firms who will not deal with amateurs. All the same, I am very much obliged to Mr. Smith for trying to assist me.”

[Try the Britannia Co., Colchester. I think they will be able to assist you, and you will certainly receive civility and attention.—ED.]

### Soap Making at Home.

W. P. (*Llanfair P. G.*)—The article you speak of, which appeared in Vol. I. of the First Series, was intended to show how a waste product might be profitably utilised. Where you have to buy the grease, it would naturally increase the cost; however, I cannot see that, even under those circumstances, you have anything to complain of in the matter of price, for according to your own showing you get an excellent soap at a cost of 1½d. per pound; and upon making enquiries in my own household I am told that a good soap cannot be bought under 3d. per pound. Some of our readers may be able to give you a hint, and therefore I will print your letter:—

“In some of the early Volumes of AMATEUR WORK I found how to make soap, and have been very successful, but cannot get the materials cheap enough so as to make the business pay—that is, tallow or grease is what I cannot get cheap. It will take 5s.

worth of caustic soda and 1s. 6d. worth of tallow (2d. per pound) to make 120 pounds of good soap. This is too much outlay for materials; 120 pounds should not cost more than about 13s. Can you help me? The quality I have been able to get has made me very anxious to know more about it. Is there any other material that can be mixed with the tallow or grease, so as to make up the weight at a less price?”

[No need to apologise for asking questions. I am always pleased to hear from my readers.]

### Dividing Circles.

C. T. VARLEY.—I am much obliged for the scale you send, but regret to say that it is not sufficiently accurate to reproduce. Tested with circles under six inches radius it was considerably out.

### Folding Bed and Table.

CHARLEY FAUST (*India*).—You and your friends who are anxious to make these useful articles of camp furniture may expect some papers on the subject in the next Volume. I have put the matter in the hands of a capable man who understands the practical requirements of this class of furniture.

### INFORMATION SOUGHT.

#### Uses for Cardboard.

A. E. R. writes:—“Could you tell me how to use a quantity of cardboard which up to the present I have thrown away as useless. Could not several fancy articles be made with this?”

[I hope several of our readers will oblige with suggestions.—ED.]

### Pin Puzzle Box.

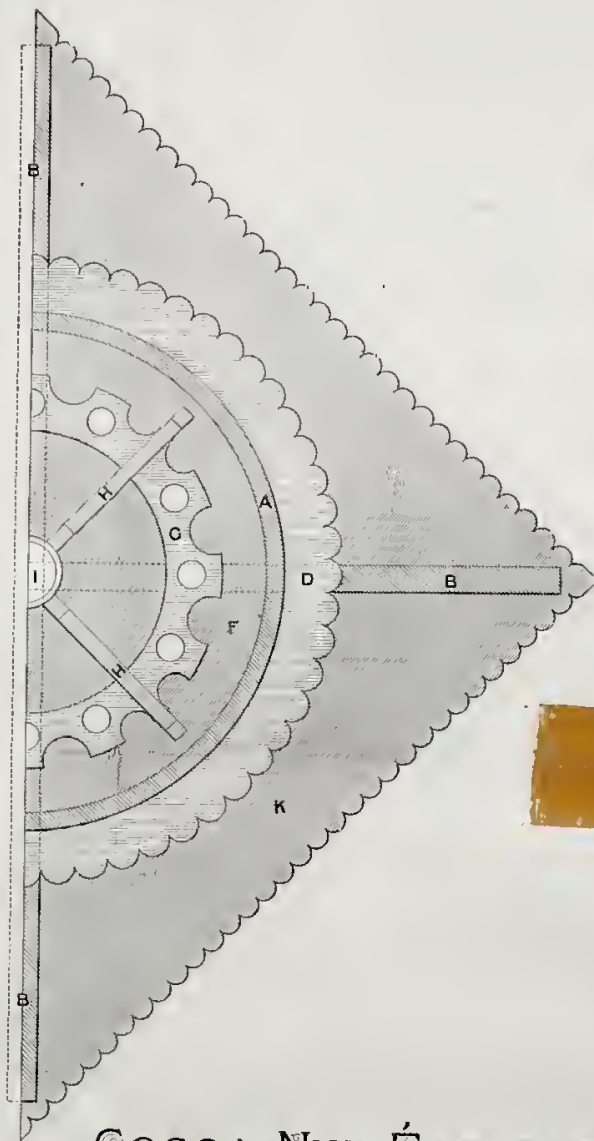
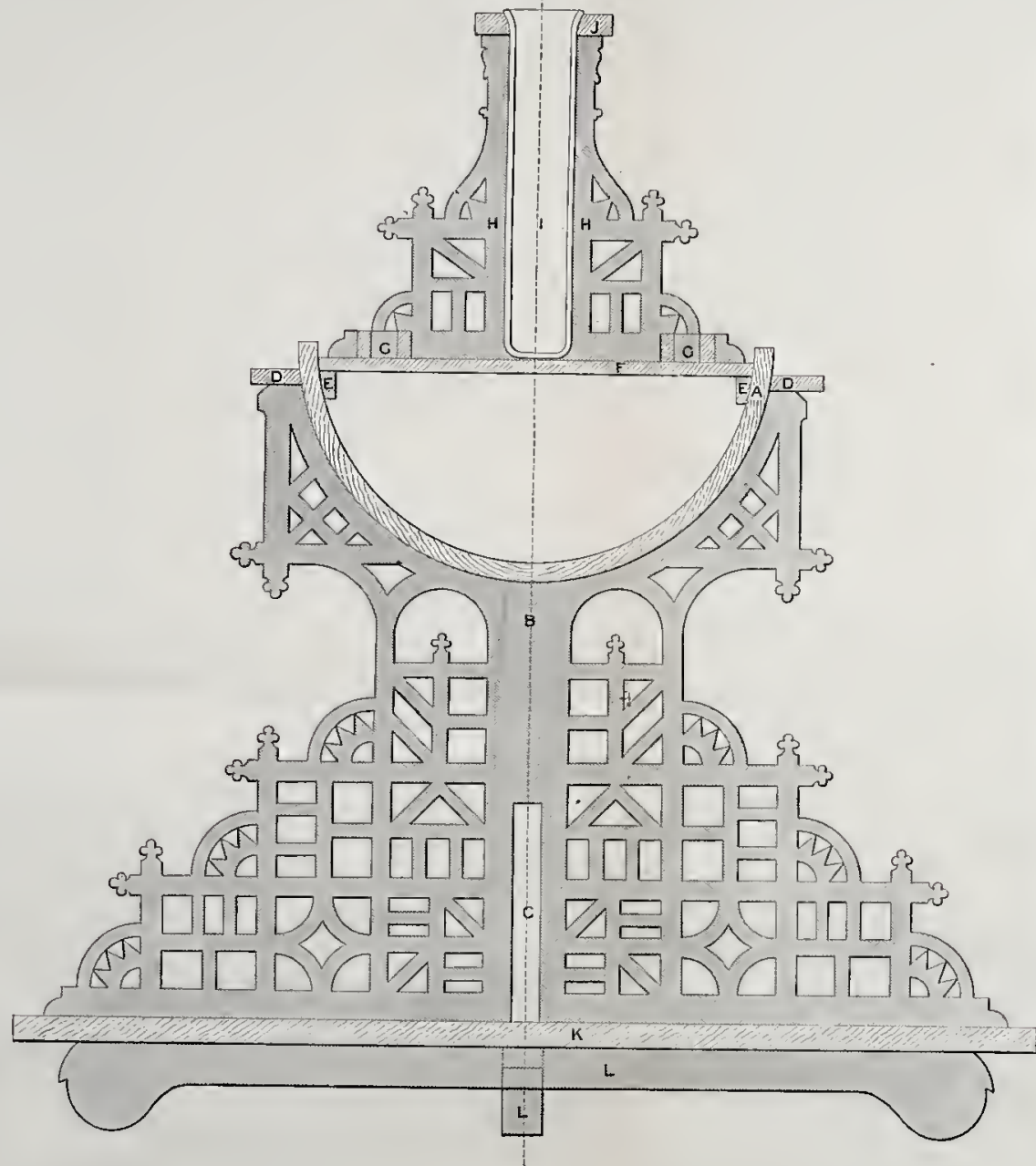
H. J. W. asks:—“Can one of your multifarious readers inform me how a pin puzzle box is made, so that when a person tries to open it a pin or sharp-pointed instrument pierces the thumb? A descriptive drawing would much facilitate the making of same.”

### LETTERS RECEIVED UP TO JUNE 4.

POGLI; E. C. K.; H. J. W.; PAINT REMOVER; Ego.







COCOA NUT ÉPERGNE.  
BY  
Z. Y. X.







# THE MYSTERY OF STATIONERY FORWARDING.

## ACCOUNT-BOOK BINDING.

By *ALFRED BEAN.*

### V.—HOW TO MAKE AN INDEX.—FINISHING.

**T**HE final step in this happily not inscrutable mystery of forwarding may now be taken by proceeding to attach the marble end-papers of the ledger to the interior of the protecting boards. To do this in

recess, thus formed, fasten the end-leaf upon it in the same manner as described for the unlined volume.

Although the promise implied by the title to these chapters on account-book binding may now be fairly considered as fulfilled, still I think this subject would scarcely bear dismissal until a few words were said on the more simple methods of finishing, and also on the work of cutting out an index, which item in the book-keeper's library may either be bound up with the ledger, into whose contents it affords ready

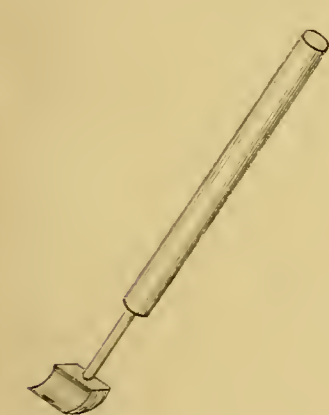


FIG. 11.—POLISHING IRON.

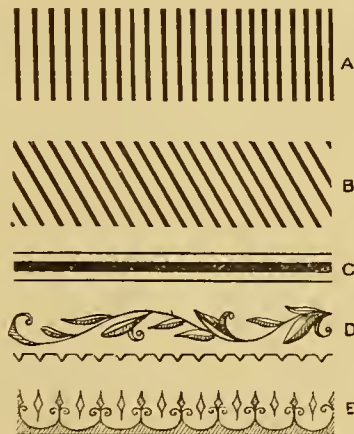


FIG. 12.—ROLLS AND FILLETS.

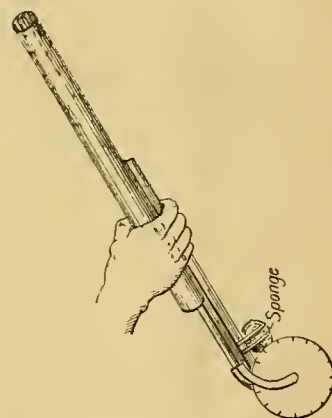


FIG. 13.—MODE OF USING ROLL WITH THE IRON LIQUOR.

the case of the half-bound volume (and also in that of the full covered one, if a thin leather has been employed) it is merely necessary to cover the outside leaf with a coat of thin glue, the boards being then closed and encompassed by a pair of smooth millboards, two thinner ones being also inserted next the end-paper. The ledger thus prepared may then be consigned to the press to receive its last "nip."

Should, however, the book be clothed with a thick material, two pieces of millboard, of rather less thickness than that of the covering, must be cut to the size of a leaf of the book, minus about an inch each way. One of these pieces should be placed to the inside of each of the boards of the ledger, a similar margin being allowed at each edge, then run your knife along the limits of the loose board, cutting away the surplus leather. The piece being then glued into the

insight—this being the more usual plan—or it may be contained in a simple cover of its own. In either case the procedure in respect of the cutting is the same.

Each leaf should first be strengthened, or backed, with a piece of calico on the underside, at the place where the letter is intended to appear, in order to guard it from being torn away with the constant handling. The position of the letter might, of course, be found by simply dividing the length of the book into the same number as that of the letters contained in the alphabet, a method which would do quite well were only an odd book or so intended to be treated. To save the necessity, however, of dividing each single book when many volumes are required, it is the practice to use one or more boards drawn out for the purpose, as follows.

The most useful size on which to sketch this

scale will be a medium folio, No. 3, which board must be covered on both sides with a strong drawing paper, after which divide one of the longer edges on the one side into twenty-six parts, drawing a line through the centre division right across the board; from this centre line, but along the edge as yet unmarked, measure off towards each end distances two-thirds those of the first spaces, and connect the corresponding marks. You may then project a similar centre line on the other side, and, after measuring from one end divisions rather exceeding those last made, and on the remaining edge distances two-thirds those of the preceding one, connect the points so indicated in the same manner as before. The board as thus drawn out will serve, I may say, for a book of any size between foolscap quarto, on the one hand, and medium on the other.

In using this scale, which should be pushed underneath the last leaf of the index until the top and bottom lines just touch the corresponding corners of the book, the first single leaf must be marked, near the edge, and opposite the second line on the scale, with the point of a hard pencil, so that an impression may be made on the leaf next below, which leaf again must be similarly distinguished opposite the third line on the board, and so on through the whole number of leaves. The above method applies only, of course, to the single letter index. Should you purpose having two letters represented on each leaf, the first mark must be made against the third scale line, the second at the fifth, the third at the seventh, etc. In indicating, on the contrary, an index having two leaves to each sign, every other leaf only, commencing at the first, should be impressed.

Having in this manner pointed out the proper position of each letter, you may cut a number of pieces of white label cloth or buckram to a length three times that of the space devoted to the letter or letters on each leaf, the width being made of about a half more than the length of a single letter space. The two corners at one edge of these pieces should be removed, to give them a neater appearance. Now coat with a layer of thin glue a piece of hard waste-paper, and then immediately cover it with five or six of the pieces of cloth, laying over these again another waste

sheet, through which the cloth may be thoroughly but quickly rubbed over, in order to make each piece take up its quota of glue.

Now place the straight edge of one of these tabs to the under side, and close to the corner of the first leaf of the index, the next and succeeding ones being then affixed, so that the mark on the leaf covers the centre of the strip of cloth. Half a dozen pieces, as I have mentioned, are sufficient to glue at one time; if more are laid down, the probability is that the cloth last put on will not properly adhere.

As soon as these lining-tabs are quite dry, the index may be cut out, a procedure which besides the knife will require a strip of tin or zinc about a couple of inches wide, and of the length of the book, and, if possible, an iron straightedge. The strip of tin must be placed under the front edge of the first leaf (the one fastened to the end paper), and the straightedge over the marble end-leaf; its upper end being at about the distance of half the width of one of the above pieces of cloth, from the top corner; the bottom end being placed at a rather greater distance from the lower corner, according to the round of the book, which, as a little reflection will show you, is the cause of this necessity for placing the rule in an oblique position. If the straightedge were laid quite parallel to the edge of the index, each separate cut would, you must see, give a letter space of a degree narrower than the preceding one, thus granting finally, when the last leaves were reached, anything but proper accommodation. Of course, in the case of a separately covered index, which would be made with an uncurved front, the rule would necessarily be laid parallel. Again, the method of deflecting the straightedge, though answering very well indeed for an index ruled with faint line only, will not suffice if perpendicular lines of any kind are existent, as the consequent variation of the cut edge from the parallel would then be painfully visible. In such a case each cut must be separately compassed from the edge of the leaf.

After severing the first strip to suit your particular case, the tin or zinc must be removed for reinsertion under the next leaf (if a two-leaf index, the next but one), which should be cut

evenly with the end-leaves as far upwards as the pencil mark, at which point the strip must be cut across; the corner under the letter space may also be slightly cut away to give the index a neater appearance. The remaining leaves may then be cut in the same style, care being taken not to cut any further than necessary.

The spaces may now be filled with the letters, which may be either type printed, or written by hand, as preferred. In either case they will look much nicer if executed in red and black ink alternating.

*Finishing.*—The plans ordinarily adopted in the finishing of stationery work enable the amateur to succeed with a great deal fewer tools, fortunately, than would be necessary in the pursuit of the sister branch. Two or three suitable rolls and a polishing-iron, indeed, are all that he need purchase; pieces of various sizes lettered journal, day-book, ledger, cash-book, etc., are kept in stock by all in the trade, and may no doubt be easily obtained from them at reasonable prices. For rough calf or goat work you will also require a little iron liquor, which may be obtained from the leather tanners. For other leathers a creasing cord will be necessary; this, however, being merely a piece of whipcord about 18 inches long, with each end secured to the centre of a short piece of wood, may easily be made by the user.

Now to the book. The first portion to be finished must be the inside of the boards, which should be well polished with the hot iron. A sharp circular motion should be given in using this tool, which of course must be perfectly smooth; if otherwise, it must be rubbed over a board on which a little fine emery has been sprinkled. It will be as well, too, to pass over the surface of the marble paper a slightly greased cloth before polishing, in order that the paper may be prevented from adhering to the hot iron. If the sides of the volume are cloth covered, the edges also of the boards should be polished, after which your attention may be given to the exterior portion of the covering. Taking first the procedure for Persian calf, red basil, or other smooth leathers, the first thing necessary is to sponge off all paste or dirt which may have gathered on the leather during the

handling; great care, however, must be taken to prevent any moisture being allowed to reach the cloth, should that material be present. If you have permitted this substance to get defaced, your only resource is to varnish. A suitable one for this and similar purposes may be prepared by grinding 2 ozs. of gum benzoin with the same quantity of shellac to a fine powder, and mixing with about 5 ozs. of methylated spirit; it should then be allowed to stand a day or two, that the powder may get thoroughly dissolved.

For the cleaning of rough calf and rough goat you must obtain a couple of pieces of pumice-stone, together with a very hard brush. Rub the pieces of pumice-stone together over the book until the leather is covered with the dust; then give it a thorough good brushing in every part, not forgetting the edges and squares; any obstinate patches may be removed by the use of the stone itself.

Now mix a little of the iron liquor in a suitable jar with a modicum of paste, into which dip a small piece of sponge which has been tied to the end of a flat stick of about 6 inches long. This stick must now be placed against the handle of a roll of the pattern A or B (Fig. 12), with the sponge resting on the design, as shown in Fig. 13. After trying this roll on a strip of waste leather until you have succeeded in forming clear and unblotched lines, open the boards of the book, and roll over all the leather visible on the inside; then close them, and similarly cover the leather exhibited on the edges, including the extremity of the head and tail of the back.

This back may then be divided into panels, of which, as a rule, it should contain six, although this is by no means an unbreakable enactment; indeed, for small books you will find it much better, I think, to use five only of these divisions. Whichever number, however, is decided upon, you must remember to make the lowermost division of a length of about one-half only that of the others, the top panel, on the contrary, having the width of the square added to its length.

The label—ledger, journal, or whatever it may be—must now be cut to size, and after being pared, attached with strong glue to



the second panel marked out on the back, after which it should be rubbed over with the polishing iron (Fig. 11). You may then treat the roll, *c*, in the same manner as the first, using it on each side of the piece, across each division, on the back, and also near the edge at the head and tail. You will no doubt find it rather difficult at first to pursue a course over the curve parallel to the ends; but this object must be attained, nevertheless, if you wish the book to look its best.

Now take a roll of a pattern something in the style of either of those shown at *D* and *E* (Fig. 12), and in the case of the half-bound book employ it in lining the back and corners where met by the edge of the cloth. Its position on the full side of leather is near the edge of the boards, where, in order to prevent a kind of hotch-potch of the design being formed at the corners, it will be as well to place at these positions small pieces of paper, their edge dividing each angle; this should make the pattern mitre exactly.

So much for the rough-surfaced leathers. To turn now to the Persian calf, and similar smooth-faced varieties, on the back of which, after the panels have been indicated, and the label affixed, as already described, creases must be formed by means of the before-mentioned creasing cord. For this the book should be laid on its fore-edge, when the string may be placed at about  $\frac{1}{16}$  of an inch from each side of each respective division mark, the handles being one on each side of the book, any surplus cord being wrapped around them. By then depressing each of these handles in turn, the opposing one being at the same time allowed to rise, whilst both are manipulated firmly and quickly, you will form underneath the cord a highly-polished groove. Besides so treating the divisions of the panels, this double line must also be impressed near the head and tail. The roll, *c*, being heated and run along the leather near the edges of the cloth, or round the edge of the board—the former treatment for the half-bound, the latter for the full-covered volume—will supply the final touch to that specimen of your stationery. It only remains now to describe the simple ornamentation given to the

vellum-bound book, which consists merely of a double line ruled around the edges of the board with ordinary red or blue writing ink.

And now, having done my utmost to make these chapters convey to you as much of the most useful portions of the stationery binder's art as they possibly can, may I, in conclusion, express here my hope that you will in return do your utmost in their practice. We may then, I think, fairly expect the professional forwarder to do his best in order, if possible, to keep ahead of his amateur rivals.

## THE ELECTRIC BELL IN ITS SIMPLEST FORM: HOW TO CONSTRUCT IT.

By JOHN H. MILNE.

### I.—MAKING THE MAGNETS—MAKING AND WINDING THE BOBBINS.

**I**N the following article it is intended to describe how, with a very small amount of labour, the simplest and least expensive form of “trembling” or “vibrating” bell can be constructed.

Electric bells are usually classified in reference to the diameter measurement of the bell or gong. The  $2\frac{1}{2}$ -inch bell is usually taken by way of example, as it is the size most generally in use; so we here adopt it.

The first thing, then, will be to make the magnets. Procure a piece of iron rod  $\frac{1}{4}$  inch thick, and bend it into the form of the letter **U**. If it be worked while red-hot, it is of course more pliable and manageable. It should be about the measurement given in Fig. 1. From *A* to *B*, say  $1\frac{1}{2}$  inches; *A* to *C*,  $\frac{3}{4}$  inch. The legs should be perfectly straight, of the same thickness, and should be filed up, so as to take out the inequalities of the iron as much as possible.

In bending the iron, particular care must be taken that the bend is made as much as possible below the points *B* and *D*, so as to leave the parts between *A* and *B* and *C* and *D* quite straight, in order that the bobbins, which have to fit on the legs, may do so closely and neatly. It will be apparent that this cannot be done if the

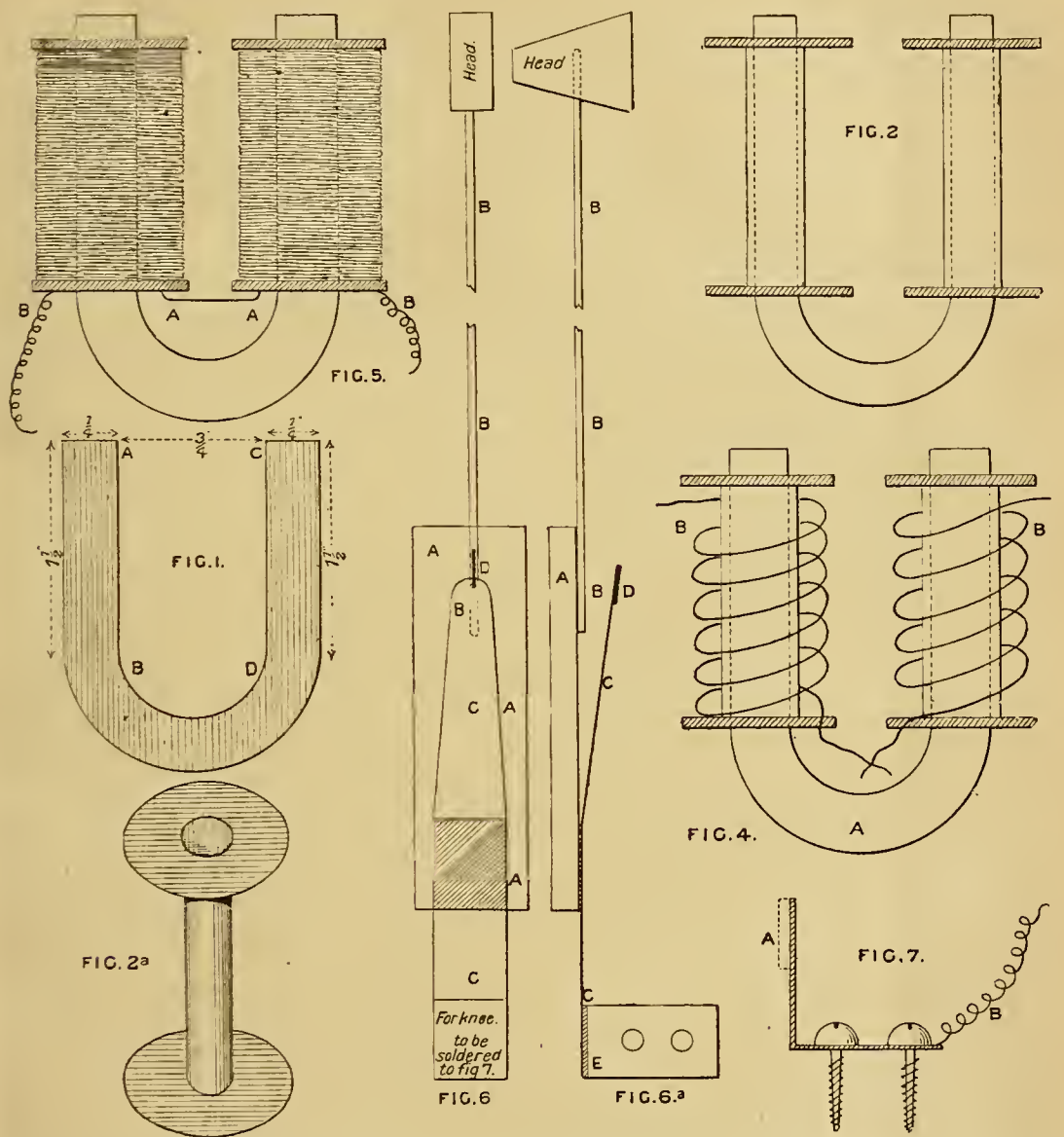
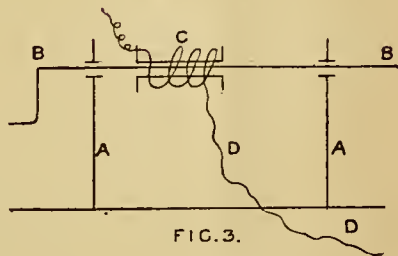


FIG. 1.—SHOWING FORM AND MEASUREMENTS OF HORSE-SHOE MAGNET. FIG. 2.—SECTIONAL VIEW OF MAGNETS OR CORES FITTED WITH BOBBINS. FIG. 2a.—BOBBIN. FIG. 3.—ARRANGEMENT FOR WINDING BOBBINS; A A, SIDE OF BOX CARRYING SPINDLE; B B, MOVABLE SPINDLE ON WHICH BOBBIN, C, IS FIXED; D, WIRE IN PROCESS OF WINDING. FIG. 4.—SHOWING MANNER AND DIRECTION OF WINDING WIRE ON THE BOBBINS; A, MAGNET OR CORES; B, INSULATED WIRE. FIG. 5.—SHOWING APPEARANCE OF CORES AND BOBBINS WHEN WOUND WITH INSULATED WIRE; ENDS ATTACHED AFTER PASSING THROUGH HOLES A A, AND LOWER ENDS PASSING THROUGH HOLES B B. FIG. 6.—ARMATURE, ETC.; A, ARMATURE; B, HAMMER LEVER; C, ARMATURE SPRING; D, PLATINUM POINT; E, SUPPORT FOR ARMATURE SHOWN IN FIG. 7. FIG. 6a.—SIDE VIEW OF FIG. 6. FIG. 7.—SUPPORT FOR ARMATURE; A, END OF SPRING MARKED C IN FIGS. 6 AND 6a; B, WIRE ATTACHED FOR CONNECTING.



bend continues far into the legs. A very good thickness for magnets, but more difficult to work, is  $\frac{3}{8}$ -inch diameter iron rod, and Swedish iron is the best for the purpose.

Having obtained a satisfactory shape, and squared off the ends of the legs at the points *a* and *c*, the iron must now be purified and softened, or, as it is called, "annealed." This is done by putting the magnet into a bright red fire, and allowing it to lie there till the fire goes out, when it can be taken from the ashes and trimmed up with a file. The reason for this process is that hard iron holds magnetism imparted to it for a much longer time than soft iron. Now, the very principle and success of the electric bell is that the iron magnet should be capable of being magnetised and demagnetised (*i.e.*, acquiring and losing its magnetism) instantly, and the softer the iron can be rendered the better it will be for this purpose.

If the magnet were fitted without the annealing process, the armature (afterwards to be described) would be constantly found to be adhering to the magnet, and the bell would be prevented from ringing. The neglect of this has been the cause of much unsatisfactory working in bells.

Any one who has a knowledge of ironworking will be familiar with the totally different results obtained by allowing iron to cool gradually, and hastening the cooling process by artificial means. The former softens the iron; the latter hardens it. As the reader may not heretofore have given the subject very particular attention, it will be well, in passing, to draw his attention to this important point.

If the iron is allowed to cool with the fire, the process is slow, but the best results are obtained. If it be taken out of the fire to cool, the process is hastened unduly, and the results are not satisfactory.

The bobbins must now be made and fitted on the iron legs, or "cores." Get two empty cotton reels, each about  $1\frac{1}{4}$  inches long, and about  $\frac{3}{4}$  inch diameter, which, it will be found, on being fitted on the magnets, will leave about  $\frac{1}{4}$  inch between the inside rims of the bobbins. The bobbins should be made to fit on the cores, leaving about  $\frac{1}{8}$  inch of the cores projecting clear of

the bobbin at the top, as shown in the diagram, Fig. 2. The space between the bobbins is left for a wood screw, about 1 or  $1\frac{1}{4}$  inches long, to pass, so as to hold the magnet in position. The hole through the centre of the bobbin, if too small, can be enlarged with a penknife, or rasped out to near the size, and then worked on to the core with the hand, when a good fit will be obtained.

It will be now necessary to hollow out the bobbins to the shape shown in Figs. 2 and 2A. This can be done with the penknife, and, when the wood has become very thin, rasped down. The best bobbins for magnets are generally made of boxwood, and are turned down to size on the lathe.

The bobbins must now be wound with wire; and as this is a matter of importance, particular attention must be paid to it. The size or thickness of the wire is proportional to the size of the magnet. A thicker wire is used for the magnets where the line wire or circuit is short. On a long line the wire of the magnet will be much finer. Some electricians are very particular in preferring silk to cotton covered wire, as the silk is a better insulator, and takes less space, the great object being to get the coils as perfectly insulated, and as near to the cores as possible. Cotton is, however, used very largely, possibly on account of its being much cheaper (about half the price), and if of good quality, and especially if better insulated by being soaked in melted paraffin wax, it is almost equal to silk.

Two ounces of No. 24 or 26 B.W.G. (Birmingham wire gauge) should now be wound on each bobbin from one end to the other, and layer upon layer, like cotton is wound on a reel. It should be stated that the rule, the more wire the stronger the magnet, holds good only to a certain extent, as such a quantity of wire may be put on as not only to be useless, but to be prejudicial and weaken the magnet. It may be stated, as a general rule, that it is useless to put on more than would make the bobbin three times the diameter of the iron core. The bobbins are quickly and evenly wound on the lathe, but a machine called a "winder" is commonly used (referred to in a prior article on "The Telephone, and How to Construct it"), a drawing of which is seen in Fig. 3. It consists



of a piece of iron wire made into the form of a handle and spindle, passed through the sides of a box, on which the bobbin is fixed. With the exercise of a little patience the wire can in this way be nicely and easily wound by one hand, while the other turns the handle. The manner of winding is peculiar, and will have to be strictly observed. It must be wound in the same direction, as shown in Fig. 4. If the lathe or (as above) the winder is used, the bobbin must revolve from the operator, and the wire should begin from the end near the handle of the winder. About 4 inches of wire should be left free at each end, and when finished the two bottom ends should be twisted together, and if soldered after, it will be an advantage.

The magnet will appear as in Fig. 5.

Some electricians prefer to make two small holes in each bobbin. The under, or core end of each wire, is brought out through A A and joined together. The outside end of each wire is brought out at B B, the winding being terminated at the same end as it commenced. Others prefer not to bring the wire through any holes, nor to finish at the same end. Perhaps for neatness the former is preferable.

If the reader will take the trouble to dip the bobbins, after being wound, in melted paraffin wax, as well as so treating the wire, prior to winding, he will find there will be less leakage of electricity, and more likelihood of better ringing.

The bobbins, being wound, are now placed on the cores, as shown in Fig. 5, and the magnet is finished.

(To be continued.) 509

EIKONOGEN DEVELOPER IN TWO SOLUTIONS.—A correspondent of *The Amateur Photographer* gives the following, which he claims will keep for a long time in two solutions: No. 1.—Sulphite of soda, 6 ozs.; hot water, 60 oz.; Eikonogen, 1 oz. No. 2.—Carbonate of potash, 4 ozs.; water, 22 ozs. To develop normally exposed plate add to 4 ozs. of No. 1, 1 drachm of No. 2. After the image has begun to appear, add from 1 to 3 ozs. of No. 2, to give density.

## A COMBINED TABLE, DESK, AND EASEL.

By JAMES SCOTT.



PEEP into most of the furnishing establishments, either in the east or west of London, reveals to the eye an accumulation of peculiarities. Competition is to be blamed or praised for the vast number of curious-looking articles of furniture, originality sometimes counterbalancing the advantages to be derived from the use of one or several articles which contain that originality. Combination furniture is gradually, or I might say rapidly, increasing, both in number of articles produced, and the uses to which each of those articles may be put; but some designers seem to give more thought to the appearance of any particular piece of furniture, than they do to the utility of it. I do not mean to say I condemn this originality, it is commendable in many instances; but I do say that utility should receive the preference in cases where a slight, or even a great, sacrifice of beauty or prettiness would accomplish it.

I cannot claim much, so far as originality of appearance is concerned, in the present design, nor should I like to say that the article possesses much merit in this direction; but I certainly think I may claim originality of combined utility and method of obtaining that utility. The drawings represent an article which can be put to the uses of table, desk, or easel, or, instead of this latter, music stand. I will not mention all the cases in which such an article would be found of great service, as no doubt among my many readers will be found some whose opinions may vary greatly as to the most convenient abode for this description of thing; but I may say that in an artist's studio, in a general establishment where show stands are required, or in a drawing-room, where it would be handy for the display of pictures, etc., it would prove useful. At any rate, I will follow these remarks with a brief description of the method of making one of these tables, and leave it to the reader to pass judgment upon it.

First comes the top: this may be of any thickness;  $\frac{3}{4}$  inch, however, is preferable. It is 36 inches long and 18 inches wide, and is divided into three pieces, the middle piece being 4 inches wide. They must be hinged to fold downwards,

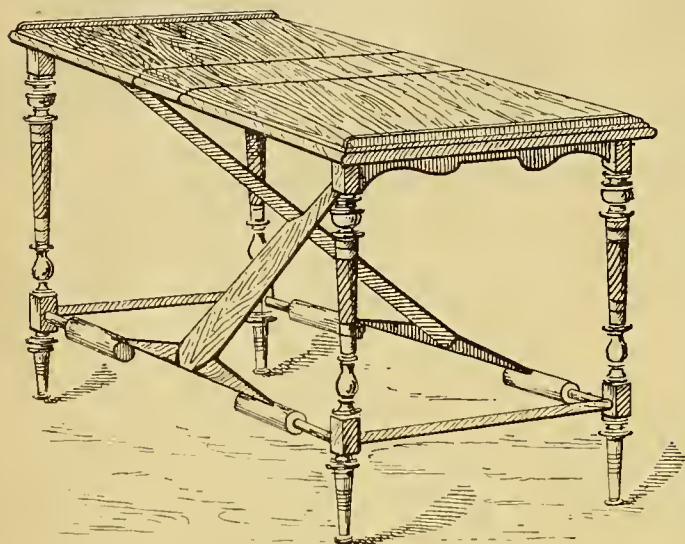


FIG. 1.—USED AS TABLE.

as in Figs. 2 and 3; a narrow strip of wood should be joined along the top of each end, to hold a picture, or whatever may be placed upon it. If intended to be used as a music stand, it will require a pair of small hooks or pins, to keep the pages of the music book open, on each side. It is so simple to make these latter, that I shall not stop to say any more about them.

Next come the legs: each will be 27 inches long, and  $1\frac{3}{4}$  inches thick. Each pair must be framed together by means of the top-shaped piece and a stretcher rail; and are hinged under the table top. It is advisable to have these legs framed, to allow the table top to overlap them by  $\frac{3}{4}$  inch or 1 inch. To the bottom block of each leg is attached a small rod, the end of which is spiral, like a screw; concerning which I will say more later on.

We want two pieces, shaped as shown, under

the table; being reversed, they are permitted to cross each other, as in Fig. 1. The length of each will be 26 inches, the bottom end being 4 inches wide, while it gradually slopes to a width of 2 inches at the top. On the bottom end of each of these pieces are hinged a pair of triangular pieces, as in Figs. 5 and 6; these are, in their turn, hinged to the pieces marked A in Fig. 4.

When the pieces under the table are pulled apart, they naturally raise the middle piece of the table top, and draw the ends of it closer together. The legs being thus brought nearer to each other at the top, require something to bring them to the same distance at the bottom, as it is apparent that otherwise they will there remain the original distance apart. To effect this, the pieces marked c in Figs. 5 and 6 are hinged firmly at one end to the tubes marked

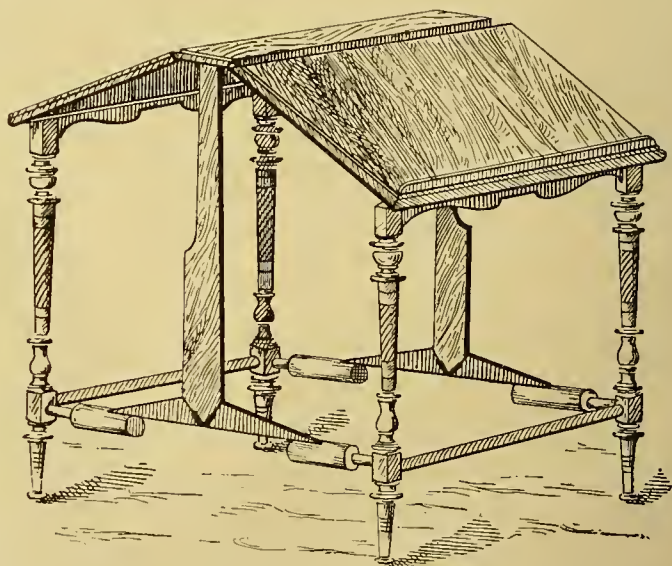


FIG. 2.—USED AS DESK.

a in Fig. 4, which, of course, must be cut properly to admit the flat surfaces of the hinges. The ends of b in Fig. 4 (one of which rods is fixed to each of the bottom blocks in the legs) being shaped as shown, it follows if they are fitted



within the tubes A, that when the cross-pieces are drawn apart, the tubes A will draw the rods B into them, in a similar manner to that shown in the screw of a dining-room table; but as each tube will only revolve about an eighth of its circumference, it will require rather a long spiral in the ends of A and B to bring them to the proper distance. Of course, all this could be dispensed with, and plain rods and tubes be used instead, B requiring then to be pushed by the hand into A; but I think it would be best to have it as I describe, as then the one movement would do all that was wanted. Thick-

all parts at once; and if a small hook is attached to one only of the tubes, it can catch

into a pin or eye on the opposite tube, and prevent the article spreading open. According to the angle the article is adjusted as an easel, depends the length of the tubes A; and I should advise the maker to leave them until last, when he can have them made to any length, after first deciding on the angle he wishes to have the table top slope to. Two notches (Fig. 8) under the middle piece of the top will serve to keep the cross-pieces in position, whether horizontal or otherwise.

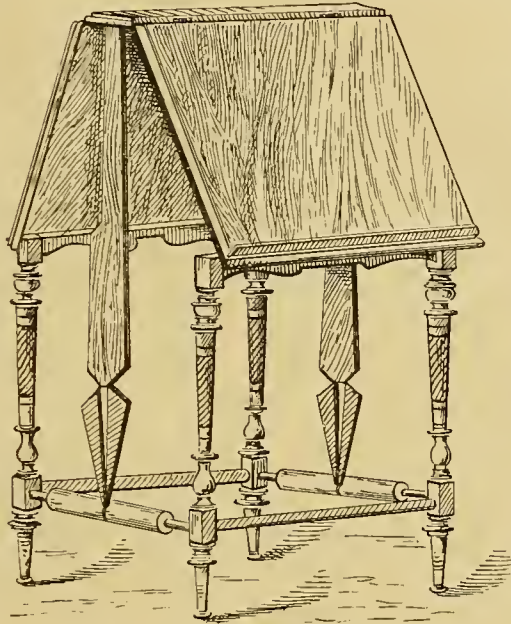


FIG. 3.—USED AS EASEL OR MUSIC STAND.

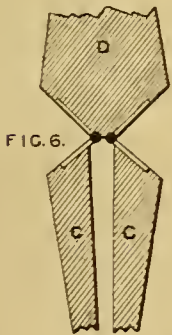


FIG. 6.

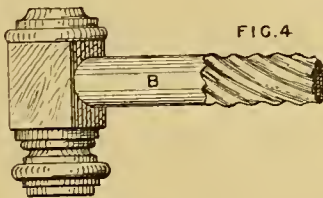


FIG. 4.

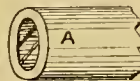


FIG. 7.



FIG. 5.

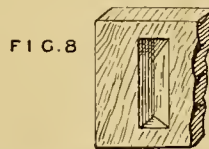


FIG. 8.

FIG. 4.—SHOWING SMALL RODS ATTACHED TO LEG BLOCKS, AND TUBE B WORKING IN A.  
FIG. 5 AND 6.—SHOWING HOW TRIANGULAR PIECES ON EACH SIDE OF TABLE WORK.

FIG. 7.—SHOWING HOW TO MAKE THE STRETCHER-RAIL IF TABLE IS NOT TO BE USED AS AN EASEL OR MUSIC STAND.

FIG. 8.—NOTCHES UNDER MIDDLE OF TABLE.

ness of rods, etc., is entirely a matter of choice; but I should say, have the tubes about  $1\frac{1}{2}$  inches diameter, and the rods about  $\frac{3}{8}$ .

To adjust the article as an easel or music stand, it is only necessary to push the long side rails (D in Figs. 5 and 6) upwards. This closes

GRAFTING WAX is made by melting together three parts resin, three parts beeswax, and two parts tallow.

To COLOUR WHITE PASTEBOARD the colour of leather, soak in a solution of copperas, and then in ammonia.—*Scientific American*.



## COCOA-NUT EPERGNE.

By Z. Y. X.

*(For Illustrations, see folding sheet presented with this Part.)*

**T**is said that under the sun there is nothing new, so it is within the bounds of possibility that at some period of the world's history flower-stands of this particular kind were in common usage, or even worse, that they may still exist, for, according to *Tit-Bits*, coincidences are far more common than we are apt to believe. Nevertheless, such knowledge, however wonderful, is not of a nature to cause feelings of satisfaction when some brilliant idea striking us, we have sorrowfully to consider that, after all, there is nothing in it.

Perchance such a fate awaits this design. Be that as it may, it is before you, and left for you to decide whether or no it is worthy of being put to the uses for which it is intended. It is one of a number I have designed, having the fine milky cocoa-nut for a centre feature, and may or may not be the best of the series, each one being entirely different in treatment from its fellows.

First let us find a suitable centre; this is not as difficult as it seems. I speedily obtained two nuts, either of which was suitable without any part of the drawing requiring alteration. If, however, the nut should be of larger or smaller dimensions than the one shown in section at *A*, the support, *B*, can be either strengthened or reduced, as occasion requires, at that part which comes immediately in contact with the nut. Of part *B* cut two from  $\frac{3}{8}$ -inch wood, and if it is desired to have similar shades in wood and nut, use dark walnut, which would be the most suitable. One of these parts must be cut upwards, and the other downwards, as shown at *C*, so that the two parts may be easily fitted together. Next cut one of *D*, which is intended to form an ornamental rim or fringe round nut, and which is best affixed to *B*, either by means of glue or small brass plates, three holes being punched in each plate, the middle hole to permit of screw passing through to fix plate to *B*, and the two side holes through which to fix rim. Given a piece of thin sheet brass

and a bradawl or punch, these plates can soon be made.

Two pieces in section are shown at *E*; these may be carried round the whole of inner line of nut, or in short lengths screwed firm from the outside of nut. The heads of screws will be hidden by the fringe *D*; this forms a rim or ledge, on which rests the lid, *F*. To cut *F* it will be necessary to obtain a pattern of the shape of nut; rub black lead, or some similar substance, on edge of nut, and press on a sheet of paper, thus gaining a correct outline. It will be found that one piece of wood will make *D*, *E*, and *F*, part *E* being cut away to allow for thickness of shell. If three-quarters of an inch is cut out of *E*, it will be found to fit fairly true to shape of nut inside. Now cut *G*, which is to be  $\frac{1}{2}$  inch wide on top, and  $\frac{1}{4}$  inch deep, scalloped round edge, as shown, with holes ten or twelve in number, cut out to allow for insertion of flowers, or four larger holes may be cut, one to each quarter of lid *F*. If you choose the former method, lid *F* will require boring to correspond with *G*.

*G* can be affixed to *F* by means of glue, or screwing from underside. Next the supports, *H*, of which from  $\frac{1}{8}$ -inch wood cut four. *H* may be cut upwards  $\frac{1}{8}$  inch, and *G* downwards where they intersect. *I* is a glass tube, either ruby or brown tinted, for centre bouquet of flowers. *J* is a rim or collar retaining the top of supports (*H*) in position. To fix *J* to supports, make a brass collar with eight holes for screws through these, with four screws fasten to support, *H*, and with four more fix collar to *J*. This makes the top firm, and shows no screw heads; indeed, it is not necessary for a single screw to be seen on the face of any part of design. *J* must be fixed to *H* before supports are fixed to lid *F*.

To finish bottom of stand, *K* must be cut square from  $\frac{1}{4}$ -inch wood, and serrated on edge, as shown; to this, by means of screws from underside, affix the parts *B*, on the underside of *K* fix feet *L*, which are halved at centre, as shown in the drawing.

The above is a full description of the parts required for the completion of the epergne, but I may add that the parts above *F* may be altered materially.

Instead of supports *n*, and tube *r*, a circular rim,  $\frac{1}{2}$  to  $\frac{3}{4}$  of an inch high, might be placed in the centre, with hole  $\frac{3}{8}$  inch in diameter bored through, flowers being inserted here, the stems of which would pass, as in *g*, into the water contained in the nut. This would lessen the expense by doing away with the glass tube.

The treatment of the top, and in fact the whole design, can be so altered, that if the drawing does not meet with your approval, there is plenty of scope for the exercise of your own ingenuity.

A few words relative to the nut, and my part will be completed.

Either scrape or file the outside until all the fibre is removed; filing is the easier method. After this glasspaper will speedily produce a smooth surface, and one easily polished, either by the use of oil or French polish. The rim of nut will be improved if serrated similar to *d*, a circular-backed file being best for the purpose, the edge being thinner than a file of triangular section. The inside of nut, and the top and underside of lid (*f*), will be improved by two coats of an enamel paint, which would prevent the formation of mould, and the swelling of the lid, from the action of the water.

In conclusion, I trust that, whether novel or otherwise, the results may be satisfactory to any reader who may feel inclined to work out the design.

**IVORY GLOSS.**—There are two kinds of varnish used to produce ivory gloss on wood—one a solution of colourless resin in turpentine, the other in alcohol. For the first, pure copal is taken; for the second, sixteen parts of sandarac are dissolved in sufficient strong alcohol, to which are added three parts of camphor; and lastly, when all are dissolved by shaking, five parts of Venetian turpentine are added. In order to cause the colour to remain a pure white, care must be taken not to mix the oil with the white paint previously put on. Best French zinc paint mixed with turpentine is to be employed. When dry, this is rubbed down with sandpaper, and this is followed with the application of the varnish above described.

## AMERICAN ORGAN BUILDING.

By THOS. L. WINNETT.

### VIII.—THE "VOX HUMANA" ACTION.



WE can now turn to the next job, *i.e.*, the vox humana fan, an ingenious and useful invention attached to the American organ. This is also a patented article, and therefore we are restricted from making it for sale, as I pointed out with regard to the octave coupler.

The fan can be obtained from Mr. Marsh complete for 2s. 3d., but as there will be many who would prefer to make all the parts of the action for themselves, I will, for their benefit, proceed to describe its construction.

A little study of Fig. 68 will greatly help in understanding the principles of construction. First of all, *A* is a circular box of pine  $4\frac{1}{2}$  inches in diameter and about 2 inches deep, hollowed out to the depth of  $1\frac{5}{8}$  inches, the entrance covered with a lid made to fit it perfectly airtight. This box is stood on its side upon a foundation board, *B*,  $17\frac{1}{2}$  inches long and  $1\frac{7}{8}$ , on the end of which it is screwed, the board itself being fixed on the top of the reed board at the back of the instrument in the treble portion, just clear of the swell shutters. A communication is made between the interior of the box and the reservoir underneath by means of a  $\frac{5}{8}$  inch hole bored through the reed board. Inside the box is a wheel, made after the pattern of a water-wheel, with twelve fans of thin wood. This wheel is connected with a large cardboard fan (*O*) outside the box. Close to the top of the box a small block of wood is fixed, through which a hole  $\frac{1}{2}$  inch in diameter is bored. When the bellows of the organ are blown, causing the usual exhaust in the reservoir, the air, finding a place to enter at the top of the vox humana box, rushes through into the reservoir past the fans inside the box, causing them to revolve. The movement is communicated to the large fan outside, and the result is a vibration of the surrounding air to such an extent that when one or more reeds are sounded, the waves of sound from them are broken up, causing a really beautiful effect, very different from the so-called "tremulant"







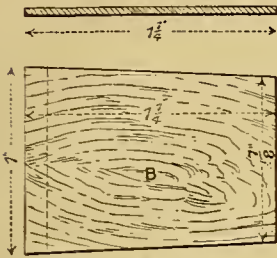


FIG. 66. Shape of fans B.  
Actual Size

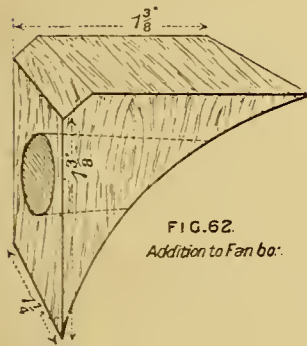


FIG. 62.  
Addition to Fan bar.

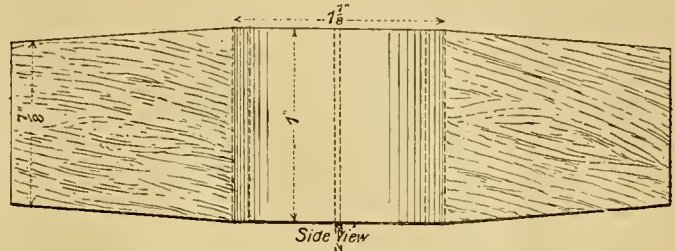


FIG. 65.  
Var-humana Wheel. Full size  
Front View

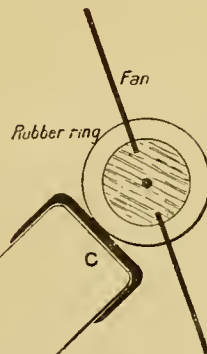
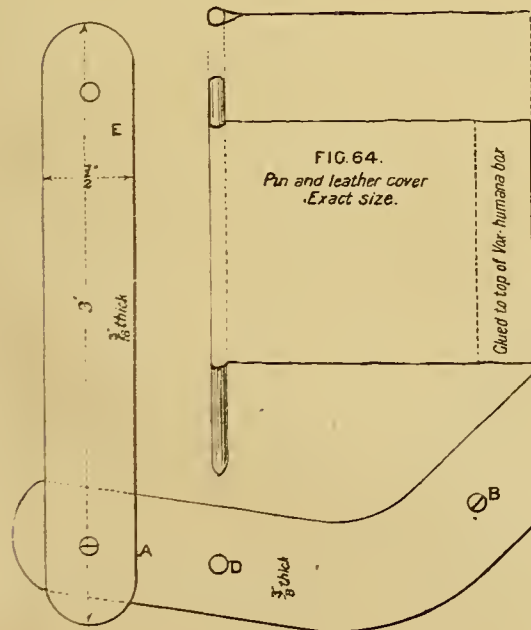
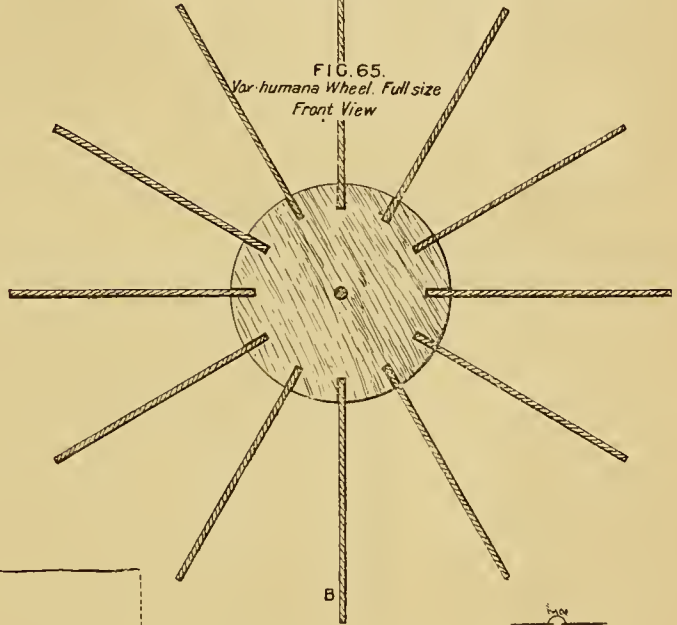


FIG. 63.  
Stop action of Var-humana  
Exact Size.

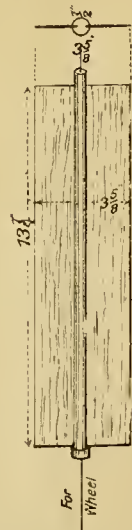


FIG. 67  
Var-humana-cardboard fan

to a pin, is brought, by a movement of the lever A (Fig. 63), over the hole in the top of the box; this causes the flow of wind past the fans to stop, and by the same movement of the lever the end c is caused to skid on the end of the fan outside, round which a rubber ring has been placed to facilitate the stopping of it. These combined movements stop the fan instantly, and the reed resumes its natural tone.

Now for the construction. Let us first make the foundation board (Fig. 59). It must be of beech  $\frac{3}{8}$  inch thick,  $17\frac{1}{2}$  inches long, and  $1\frac{7}{8}$  inches wide. The ends may be shaped for ornament as in the figure.

The box next claims attention. It may be of pine, and a lathe is indispensable in the making of it. Turn it up to  $4\frac{1}{2}$  inches in diameter, and  $1\frac{7}{8}$  inches wide. Hollow out the inside to the depth of  $1\frac{5}{16}$  inches, leaving a rim of  $\frac{5}{16}$  inch all round. A lid must also be turned, with a flange to fit tightly into the rim formed for its reception; in fact, it must be perfectly airtight, when screwed down, for the fan to work properly. Next prepare a small block of wood the shape of Fig. 62. The curve must fit the circumference of the box, and must be glued in the position shown at c (Fig. 60). The hole shown in the figure must be bored after being glued. We must now fix the box on to the foundation board  $\frac{1}{2}$  inch from one end, with the opening of the box towards that end, and for that purpose a part of the foundation board must be cut out a little at A (Fig. 59), and dished out in the centre, in order to fit the circumference of the box. Fix the box down with two screws from underneath (B, Fig. 60).

The wheel had better next be made. The centre, or "boss," should, of course, be turned in the lathe; the measurements are:  $1\frac{7}{8}$  inches diameter and 1 inch long; divide the circumference into twelve parts, and make saw cuts nearly  $\frac{1}{8}$  inch deep, to take the twelve fans shaped like B (Fig. 66). The fans may be made of soft wood, and should be  $1\frac{1}{4}$  inches long and  $\frac{1}{16}$  inch thick. When they are all glued into position our wheel will be complete, and it will only be necessary to drill a very fine hole through the centre of the boss for it to fit on to the wire of the outside fan.

I must not omit to mention that just where the wire goes through the back of the box, a boss of hard wood is to be inserted to take the wear of the wire, and if the position of the boss is arranged so that a small portion of it projects on the outside, it will form a stop to keep the outside fan away from the back of the box when revolving.

While we are, at the lathe, it will be well to turn up the support to hold the other end of the fan (Fig. 61); its height should be  $2\frac{1}{2}$  inches, and the hole to take the fan wire should be bushed with cloth.

Next proceed to make the fan. The centre part is of hard wood, circular in shape,  $\frac{1}{2}$  inch in diameter, and of the length of 14 inches. A couple of grooves must be sawn down its length, on two opposite sides, to take the two wings, which are made of cardboard, or, better still, of Willesden paper,  $\frac{1}{16}$  inch thick and  $13\frac{1}{4}$  inches long. In glueing the wings into the grooves, half an inch should be left at one end to take a flat indiarubber ring  $\frac{3}{8}$  inch broad and  $\frac{1}{16}$  inch thick. An excellent substitute would be a short length cut off a piece of indiarubber tubing. Insert in the same end as the rubber ring a stiff wire projecting  $1\frac{7}{8}$  inches, and at the other end a shorter one projecting only  $\frac{1}{2}$  inch. The wire used should be of bright steel, and the best thing for the purpose would be a ladies' steel knitting needle, broken to the required lengths.

The whole apparatus may now be fixed together. Screw down the box on to the foundation board, taking great care that there may be no leaking of the air between. Insert the long wire of the fan through the hole in the back of the box, and slip the wheel on, first putting on a small brass or zinc washer to prevent the wheel from touching the back of box. If the wheel fits tightly, it need not be glued on to the wire. Fix up the support at the other end of the fan, inserting the short wire in the hole near the top of support, which should be bushed with cloth to silence the working; the whole should revolve freely.

There is not much to make in the stop action. Fig. 63 shows the shape and sizes of the pieces of beech to be cut for the purpose. The part A, which should be  $\frac{3}{8}$  inch thick, is screwed to the

back of the vox humana box in such a position that the end c skids on the rubber ring when top part of the arm a is pulled nearly upright. Glue a piece of leather round the end c, inserting between a piece of cloth felt. Fig. 64 is a full-size drawing of the pin to be inserted in the arm a, somewhere about the point d; the exact spot will have to be ascertained when putting together. Now fix a piece of thin basil leather over the hole at the top of box, glueing at one end, as shown by the dotted line (Fig. 64). The other end is formed into a loop, in which the pin is inserted. Now, the action of the stop is this. The top arm, E, is fastened to the stop rod; when the vox humana stop is drawn, the arm, a, is pulled forward, consequently its end, c, comes away from the rubber ring, and at the same time, by means of the pin inserted in the arm, the strip of leather over the hole is drawn away forwards. The wind instantly rushes in through the hole, strikes against the fan of the wheel inside, and the fan outside rapidly revolves; shut the stop handle in, and the leather is returned over the hole, being kept tight down by the pressure of the air outside, and the fan is instantly stopped by the end of the arm again pressing on the rubber ring.

I must not omit to say that the hole in the top of the box should be bushed throughout with cloth, else there will be an unpleasant roaring when the fan is working.

I hope now that I have made this action so plain as to be understood by everyone; but if there should be any difficulty, I should be pleased to answer any questions put through the usual medium.

The whole of the stop mechanism will be considered in the next chapter.

**IMPERVIOUS PASTE.**—Soak ordinary glue in water until it softens, remove it before it has lost its original shape, and dissolve in ordinary linseed-oil on a gentle fire until it acquires the consistency of a jelly. This paste, if carefully made, may be used for all kinds of substances, as, besides strength and hardness, it possesses also the advantage of resisting the action of water.

## A SIMPLE HIVE SMOKER.

By J. L. DWYER, B.A.



HERE is no doubt but that AMATEUR WORK numbers among its readers multitudes of every class, young and old, rich and poor, learned and unlearned. To some of its readers shillings, and even pounds, are matters of no consideration, while others have to count every penny. It is for this latter class that I write a description of how I made a very simple, cheap, and effective hive-smoker. Many would like to try their hands at apiculture on the modern system, but are deterred by the somewhat high initial expenditure, who, if they could make their own apparatus, would, perhaps, add considerably to their incomes. The bees can usually be got for nothing from those ignorant possessors who smother them at the conclusion of the honey harvest. They have only to be driven from their own hive, and fed carefully during the autumn, and, with care, will come out in the spring strong and well able for the summer work.

One of the most useful pieces of apparatus we have is the smoker. It partly stupefies the bees, and, in driving, sends any which may lurk among the combs, running at once into the receiving hive. It is a somewhat expensive piece of apparatus, costing about four shillings, which is an enormous price considering the ease with which it can be made. It will be my duty to describe in this paper how I made mine, which works as well as any I have seen.

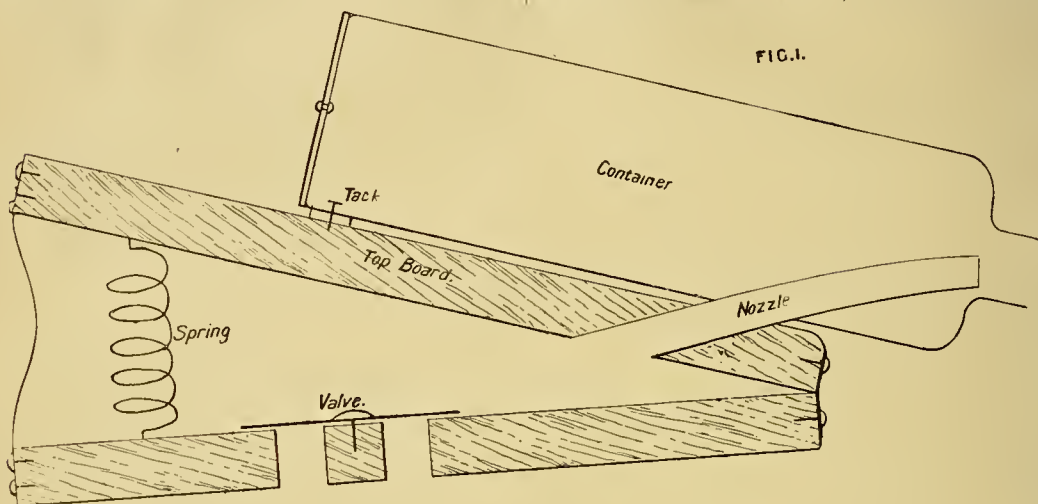
The smoker consists, essentially, of a little bellows having a spring between the boards, so that it can be worked between the thumb and fingers. Attached to the top board is a tin case, into which is put some thick brown paper, which, when smouldering, causes a dense smoke. The nozzle from the bellows enters the tin case near its extremity, and blows the smoke into the hive, or in any required direction.

Fig. 1 is a section of the smoker, which shows its action pretty clearly. The construction of my smoker cost me absolutely nothing, because I had any materials I required ready at my hand; but if I had bought everything



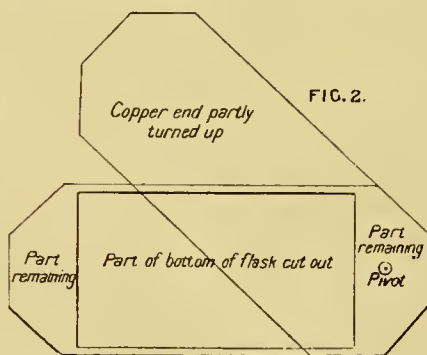
at its full price, it might have amounted to three or four pence, so that by making it I saved four shillings, which I always look upon as four shillings gained. It is in the power of the veriest tyro, one who can use only a hammer and saw and knife, to make this blower for himself.

but there would be a danger of the corners of the basil curling up; and to prevent this, attach to each corner a piece of thin twine, which is secured to a tack about an inch distant, in such a way that the valve can rise slightly, not quite  $\frac{1}{8}$  inch. This amount of play is quite sufficient to let the air in, but will effectually



The bellows is the foundation, and, therefore, the first thing to construct. Two pieces of board 6 inches by  $4\frac{1}{2}$  inches, and about half an inch thick, and a piece of basil leather are required. The latter, 20 inches by 3 inches, I got from the saddler, who would not charge for it.

The boards must be cut so that one fits over the other pretty evenly; for one forms the top, and the other the bottom cheek of the bellows. A valve must be prepared for the bottom cheek. Nothing is easier to do. Bore four  $\frac{3}{8}$ -inch holes 2 inches from one end of the cheek, and equal distances from its sides, leaving  $\frac{1}{4}$  inch of wood between each hole. The four will thus form a rectangle. A piece of basil  $1\frac{3}{4}$  inches square is laid over the holes so as to cover them all, and a tack in the middle secures it in place. The valve would work satisfactorily without doing anything further to it, I imagine,



prevent the valve from turning over, and the corners from curling up.

The two boards are then laid together with the valve inside, and a strip of basil,  $4\frac{1}{2}$  inches long and 1 inch wide, is tacked across the ends of both boards, thus forming a hinge. I used wire tacks with broad, flat heads, and placed them about  $\frac{3}{8}$  inch apart. The spring must now be made. It consists of a piece of hard brass wire twisted five or six times round a piece of wood about  $\frac{3}{4}$  inch in diameter. It thus forms a spiral spring about 3 inches long. The ends of the wire are left about  $\frac{1}{2}$  inch long, and turned in the direction of the axis of the spiral.

Two holes are put in the cheeks of the bellows near the end which has not the hinge, and the ends of the spring are inserted in these holes. The boards will then assume the shape of a wedge 3 inches wide at one end, and 1 inch at

the other. The strip of basil is nailed right round this, and the bellows is complete, minus the exit. It is well, in driving the tacks, not to place them all in the same grain of the wood, or there would be danger of splitting the boards; they should be each a little lower or higher than its predecessor, so that the row of tacks forms a wavy line, like the teeth of a saw.

Now for the nozzle, as the bellows, so far, has no exit through which wind can be driven. A hole must be bored in the top cheek in the position indicated in the diagram. It points well forward, so that a piece of brass or tin tubing inserted in it will be at a small angle with the top.

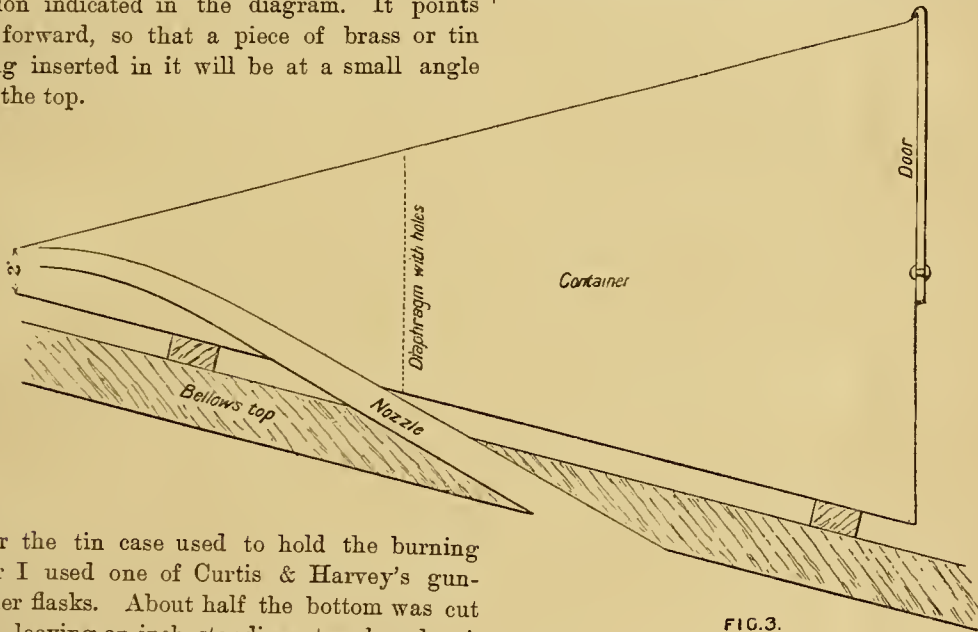


FIG. 3.

For the tin case used to hold the burning paper I used one of Curtis & Harvey's gunpowder flasks. About half the bottom was cut away, leaving an inch standing at each end. A piece of copper was then used as a lid, being cut the full size of the bottom of the flask, and pivoted at one end, as seen at Fig. 2. A hole was then bored in one side of the flask, so that the bellows nozzle would pass through pretty easily, but without leaving space for the burning paper to get at the wood, and the flask was fastened to the bellows top with a couple of tacks at the back, and a band of tin right round the flask, and tacked to the bellows towards the front end. It would be well to put a strip of tin under each end of the flask, so that a small space for air is left, which will prevent the tin heating and burning the wood. It is important that the point of the bellows nozzle should occupy the position indicated in Fig. 1, so that

when the bellows is worked it will draw the smoke from the inside of the container.

If a gunpowder flask is not available, any ordinary canister could be made to do service instead. The bottom should be perforated, and a funnel-shaped piece of tin affixed to the bottom end; the bellows nozzle would enter the latter towards its end.

Fig. 3 shows a funnel-shaped piece of tin taking the place of the entire container. A diaphragm perforated with  $\frac{1}{8}$ -inch holes prevents

the burning paper from being blown into the hive. The nozzle, as before, enters the space before the diaphragm, half the bottom is cut away, and a lid, turning on a pivot, or hinged, is made to cover the open part.

There is a danger of the heat of the burning paper melting the solder which holds the container together. A little rivet should be put here and there on the joints as an additional precaution, or, if a container is made, the joints should be of the lap description, such as are found in a tin saucepan. I trust I have made the construction of this smoker clear enough. If not, I will be happy to give further details in "Amateurs in Council."

## HOW TO MAKE-UP FOR THE STAGE.

By PROFESSOR LIONEL ARTHUR.

IV.—THE GENERAL PRINCIPLES OF MAKING-UP—PREPARING THE FOUNDATION—PUTTING ON THE COMPLEXION—ROUGING—LINING THE FACE, LIGHT AND SHADE—THE HAIR—MOUSTACHES AND WHISKERS—EYEBROWS AND EYELASHES.



HAVING described the various articles and materials which go to make up the working plant of the perruquier, I must next endeavour to give some little practical instruction in the work itself.

Mr. C. H. Fox, the noted wig maker, divides the making-up of a character into a series of stages, and the following is the arrangement he advises, viz.: 1. The preparation of the skin for the make-up; 2, putting on the complexion; 3, rouging; 4, putting on the high lights shadows; 5, the hair or wig and its adjustment; 6, powdering the face; 7, putting on the moustache and beard; 8, the eyebrows and eyelashes; 9, the arms and hands.

This is the order that anyone proficient in the art of making-up always follows, and it will be noticed that the make-up as a whole has been built up, as it were, step by step, each part of the work being divided into a section by itself. The only exception to the above order is in the case of half bald wigs, etc., and these should be put on after the operation No. 2, so that they may then be properly joined, and forehead made to match with the rest of the complexion. These few words will show that there is a method in making-up, as in all other things, a fact a good many amateur actors do not seem to realise, as it has amused the writer on many occasions to follow their antics when watching them at work in the vain attempt to perfect a realisation of an elaborate make-up. Amateurs—unless they have had a few lessons from a good man, such as an old professional actor, who has been in his day a member of a good many stock companies—generally commence the wrong way in their first attempts at this work; that is, they begin making-up by putting the wig on—perhaps hind part first—and I have even seen the whiskers and moustache stuck firmly on

even before applying the grease paints, and this without any previous preparation of the skin—a most harmful practice, I need hardly say. Now for the proper way.

*Preparing the Skin.*—On leaving home for the theatre, the actor should wash his face, hands, and arms thoroughly, in order that all greasy matter may be removed from the skin. It is best to wash first in hot water, well rinse the soap off, rinse again in some fresh hot water, and then bathe the face and hands in some cold water, so that the pores of the skin are again closed. On arrival in the dressing-room the actor proceeds to don his costume, and complete his toilet in every way but the “making-up,” etc. When dressed, a clean towel is thrown round the shoulders and tucked in round the neck. This is to save the dress from becoming soiled, or smothered with powder. The first thing to do is to close the pores of the skin as much as possible, so that the various colours may go no farther than the surface, and thus prevent any ill effects upon the skin. Take, therefore, the Fuller’s earth from the make-up box, and well shake out the puff, so that but very little powder is left in it. Now powder the face, neck, arms, and hands, taking care that the eyelids, ears, etc., are well covered, and working the powder well into the skin with the hands. Next, with a clean, dry towel wipe off all the superfluous powder, so that none is left on the surface to rub up with the grease paints when applied. The skin is now, of course, in a very dry state, and not at all suitable for taking the grease paints. The skin is therefore smeared with some pure vaseline, working it in all crevices as before. The excess is again wiped off with a dry towel, and the pores of the skin should now be effectively closed, whilst at the same time we have a nice smooth groundwork for spreading and blending the colours upon. The artist, of course, is very cleanly shaved; otherwise this desired effect would not be obtained, nor, in fact, a successful make-up possible.

*Putting on the Complexion.*—I take it for granted that the character the actor is about to portray has been previously studied, the style of make-up carefully thought out, and the wig



decided upon. This must be done beforehand, otherwise the attempt would result in a direful failure. Taking the flesh tint of grease paint which is most suitable for the character, it is applied thinly all over the face and neck. Only a very small quantity must be used, as, should it be applied very thick, in fact, literally plastered on, as is generally the case with the novice, it makes the face very uncomfortable and stiff, and prevents facial expression, one of the greatest aids to the actor's art. To ensure a thin and even coating, it is best to rub a few lines on the most prominent portion of the face with the stick of paint. The paint is then spread with the hand, and well rubbed into the eye-sockets, ears, etc., with the forefinger, allowing the colour to grow fainter from beneath the lower jaw-bone as it proceeds down the neck. The colour of this groundwork depends very much upon the age and style of character it is intended to represent; in fact, for youthful characters grease paints are hardly required, except in the case of a face much disfigured with freckles, when the light flesh tint must be used to hide these unsightly blemishes.

*Rouging.*—If grease paint has been used for the groundwork, it is not advisable to use the rouge as a powder, because it is somewhat difficult to soften it off upon a greasy surface. The carmine colour, No. 18, is therefore the colour to use, and of this a small quantity is worked in upon the cheek bones, and carefully softened off with the finger into the complexion or flesh tint. This softening off must be done very effectually, especially in cases where the audience are likely to be seated near to the actors. To give a brightening effect to the eye, a little carmine may be rubbed directly beneath the eyebrow, but keeping it clear of the lids. If the eyelids are rouged, it has the effect of making a person look as if they had been recently weeping; and this is a very effective aid in making up those characters of a sad nature. The ears, chin, and forehead should have a very slight tinge of rouge applied, and in some cases the nose may be given more prominence in this way. The colour on these portions of the face must necessarily be very faint, especially on the nose, unless one wishes

to obtain the effect of the whiskey-sodden face of the hard drinker, a make-up we will consider later on.

*Lining the Face.*—High lights, shadows, and lines come next in order, and this is the most difficult part of the art. If a dark flesh tint has been used, the high lights may be put in with a lighter tint; but if the light flesh colour has been applied, then the white grease paint is the only one at our disposal. High lights and shadows are used to bring certain parts or features into more prominent relief, either on the face, neck, arms, or hands. Shadows, again, when applied to the more prominent parts of the face, such as the cheeks, and with a high light above and below, will give a sunken effect to the face, such as that caused by prolonged starvation, wasting, etc. In using white for the high lights it must be applied very sparsely indeed, as it really shows up more from the distance than it does to those upon the stage. The shadow colours are always darker than the complexion colours, more or less, according to the depth of shadow required. Crimson lake is one of the handiest colours for this purpose, and this can be toned down with the finger into a very slight shadow. The other shadow colours are vermilion, blue, and the browns. Black is *not* used for shading purposes. Shadows and high lights should always be used together, the effect of one enhancing that of the other; thus, while a high light on the cheek bones, or a shadow above and below, will make them stand out, the employment of the two together will have a greater effect. Light and shade lends a valuable aid in putting in the wrinkles, crow's-feet, etc., of old age; for this purpose Mr. Fox uses camel's hair paint-brushes, keeping a separate brush for each shading colour, and these brushes may be had at his establishment. To fill the brush with colour, melt the top of the stick of paint by holding it near the gas, and dip the brush into it until it is quite full, press it between the finger and thumb of the left hand to remove the surplus colour, and work it to a broad surface. With this brush work in the wrinkles. For "crow's-feet" and very fine lines use the point of the brush. The paint between the finger and

thumb will serve to refill the brush by simply pressing it between them, and when the colour is no longer required it can be wiped off the fingers with a towel. A drawing stump is also used for this purpose, and this is rubbed on to the paint unmelted.

Having settled where the wrinkles are to appear, they are marked out with the brush; the colour is next toned down with a downward movement of the finger until there is no line left, but *merely a shadow*. This is very important. There must be no boldly-marked lines, or it will look what it really is, *i.e.*, streaks of paint. The deepest parts of the wrinkles are rendered darker with another touch of the lining colour, again toned in with the finger. The high lights are then painted above the wrinkles. The wrinkles running from the nostrils towards the mouth are best put in with blue for the deepest shadows, with vermilion above this, and then the high light added, all carefully toned together. The forehead may have its most prominent part brought out still further by introducing a high light, or may be destroyed by putting in a shadow. The eyes may be sunk, as already indicated, by painting with carmine or brown. By putting high lights over the bones forming the eye sockets, the eyes will appear deeper still. The lips can be made much smaller by covering a portion with the flesh tint used for the groundwork, or they may be made larger by painting with a brush dipped in liquid carmine or carmine paste. The nose can be made to look longer by running a high light down the centre. For a Jew's nose, put in a deep shadow at the top between the eyebrows, placing a high light upon the bridge. The face is now powdered to soften the whole.

*The Hair.*—If a wig is not worn, the hair can be dressed, and, if necessary, coloured with the different powders sold for the purpose.

*Moustaches and Whiskers.*—If an actor wishes to make use of his own moustaches or whiskers, these can of course be coloured to match any wig. For a large amount of whiskers it is best to make use of the hair powders for the colouring material, but if it is a moustache and a slight amount of side whisker which have to be changed in colour, then it is best to use the

grease paints for the purpose. It must always be remembered, however, that the hair on the face is lighter than that upon the head. If this is not attended to, a very unnatural appearance will be the result; but it is a defect which is often witnessed, and I need hardly say that amateurs are the greatest sinners in this respect. Black grease paint is used for black hair, and the browns for brown hair. For auburn or light hair chrome-yellow is used. As regards the false article, the best moustaches to use are those which are mounted on gauze; but professionals mainly use *crêpe* hair or German wool for beards, whiskers, etc., on account of its cheapness, and the latitude it allows them in moulding the whiskers, etc., into any desired shape at will. I must here describe the manipulation of *crêpe* hair. This article, which is an artificial material of German manufacture, is sold tightly plaited together in long lengths, and can be purchased by the yard. The following colours should be in the make-up box, *viz.* :—Black, dark brown, light brown, red, yellow, grey, iron grey, and white. For making whiskers or moustaches, we take hold of the end of the plaited hair and pull the hair, *not* the string which will be seen amongst it, when it will at once unravel itself. A very small quantity is necessary for one make-up, and this is cut off with the scissors. It is a pity to cut off more than is required, as when once unplaited it gets rough and dirty, besides taking up more room to stow away. Having cut off a short length, it is well worked out with the finger and thumb until the wavy appearance has disappeared. The hair must be pulled out of the piece lengthways, and on no account must it be applied to the face until it has been well thinned out and completely lost its waviness. When the hair has been got to this state, it is roughly modelled to the required shape of the moustache, beard, or whiskers, and it is then ready for applying to the face. Spirit gum is the adhesive employed for affixing the hair to the face, and the great art in applying both hair and gum lies in carrying out to the letter the following brief precept: "Don't use too much hair nor too much gum."

Spirit gum is nothing more or less than the



white hard spirit varnish of commerce, and to anyone with a tender skin it has, I need hardly say, a very irritating effect. In such cases I recommend the use of best glue, placed in a small bottle, and warmed in a cup of hot water at the time of using. Both the gum and glue are applied with one of the small brushes sold for the purpose. A few drops of the spirit gum properly applied will be found amply sufficient to make the hair stick to the skin with the greatest tenacity. If a lot of gum is used it is not only painful, but there is great difficulty in removing it; grease and washing in hot water being the best things to use for this purpose. The hair is next put on the face in this way:—A small quantity of spirit gum is laid on the desired spot, and allowed to get partially dry, which it quickly does; the hair is then gently pressed on, keeping it in position with the fingers, finally pressing it with the palm of the hand or a cloth until it is found to have stuck hard and fast. The whisker on the other side is then laid on in the same way, and finally the moustache and imperial, if any. The moustache, I need hardly say, is put on in two pieces. The hair being firmly secured, is trimmed with a pair of scissors to the desired shape; and this little process needs a deal of artistic taste if the hirsute appendages are to have a natural appearance when trimmed. Too much hair must not be left on the face on any account, and a clever man will trim the beard, whiskers, etc., to such nicety of perfection as to be indistinguishable from the real thing. The use of crêpe hair is troublesome at first, and occupies much time to do properly, but practice soon brings expertness and dexterity. The full beard is best put on in at least three pieces, one on the chin being fixed first, and then the whisker on each side.

*The Eyebrows, Eyelashes, etc.*—The eyebrows can be coloured to match the whiskers with any of the grease paints; or, if desired, false ones may be put on, either mounted on gauze or made from the ordinary crêpe hair. When fixing on eyebrows, place the gum on the forehead just over the natural eyebrows, and *not on the latter*, or the natural hair will get matted together, and it will take an awful time to remove the gum

from the brows. A fine camel-hair pencil charged with brown paint should next be used to mark some thin lines immediately beneath the eyelashes; this gives to the eyes a bright and sparkling appearance. The wig is now adjusted, and the make-up of the face is completed.

*The Hands, Arms, etc.*—The veins on the hands, arms, etc., in aged characters, are put in with the blue lining colour, or veining pencils, which are sold for the special purpose. In some characters the hands, etc., have to be rouged, bronzed, etc.; but this portion of the make-up had better be done with powder colours, as the large quantity of grease colour necessary for the purpose would make the process somewhat costly. I have now given a slight insight into the general principles underlying the art of making-up, and, in conclusion, must acknowledge my indebtedness to Mr. Fox for some valuable hints which I have made use of in this chapter.

(To be continued.)

## SOME PHOTOGRAPHIC WRINKLES.

By FRANK MORTON.

ADAPTING SMALL PLATE-HOLDERS TO LARGER CAMERAS—  
A SIMPLE ARRANGEMENT FOR ENLARGING—DRYING  
SENSITIZED PAPER WITHOUT CURLING—COLOURED  
PRINTS.



AMATEUR photographers do not, as a rule, perhaps, make a great deal of their apparatus, but patronise the dealers for nearly all of it. This is all right if one has no idea of making things one's self, and has plenty of money to buy all of the conveniences ready-made. There is quite a large number of exceptions to this rule, however, and many make their own cameras and other appliances. AMATEUR WORK has in the past given many pages of excellent instruction for making and working nearly everything pertaining to the art, but a few wrinkles not yet mentioned may be of interest.

For instance, if one possesses a tripod camera, and also a hand camera, as many do, he will probably have two sizes of plate-holders. Say the tripod camera is an 8 by 5, or larger, and the hand camera a 5 by 4, or smaller. Now, it



would be convenient many times to use all the holders on one excursion with the tripod camera. If the camera is one of the ordinary styles, a light framework can be made like Fig. 1, to hold the small plate-holders and fit on to the large camera. The frame holding the ground-glass would probably have to be unscrewed. But this is no inconvenience, as the frame should fit in place, and be held, as the plate-holder is, without screws, while focussing. This framework, which will be easily understood by the illustration, should be carefully made so as to fit tightly and exclude the light. The plate-holder is shown in place, being held firmly by brass springs at the back. A small ground-glass screen will have to be made to fit in it to focus by, as the larger glass does not hold the same relative position, the framework extending back further. Fig. 2 shows how the arrangement is put together, A A being curved brass springs made from common sheet brass.

Enlarging on a small scale is very simple, and an elaborate apparatus is not needed. In most enlarging cameras described, the making of extra bellows, and other apparatus, scares one by the amount of work necessary. A simple arrangement for enlarging small pictures or negatives up to the size of your camera is shown by the diagram at Fig. 3. Make a couple of extensions out of pasteboard or thin wood, and have both made to slide into the place the front board occupies, or into each other. Then one or both can be used as necessary. An ordinary pasteboard box with wooden frames, as A B, can be used, and a tapering one made, as at C. The lens fits on at the front of C and D. If enlarging from a photo, place it half as far off as from A1 to D, and it will enlarge to twice the size. If it is wished to enlarge from a negative, take another pasteboard box with one end, as at E; cut a hole in the end for the lens, and make a thin box, with both ends open, to slide on over, as at F, put them in place, resting them on blocks at G G, and fasten the negative on by the button at H. Point towards the sky, and expose your bromide paper in the regular dark slide, put an old plate box on over the negative when the dark slide is drawn, and also throw your focussing cloth over all to

guard against the entrance of light. Of course it is necessary to have the arrangement fairly well fitted together; but if it is, it will do the work as well as any camera. Sliding F on over E will allow of changing the size of the enlargement. The writer has a collection of 5 by 4 views enlarged from stereoscopic views with an apparatus like this, and they are good copies. Another good point about the arrangement is that it can be taken to pieces and packed away in a corner in a moment.

Another thing amateurs do but very little of, and that is sensitizing their own silver paper. It is rather messy work, to be sure, but there is no reason why every amateur should not be able to do it. It is not necessary to have a large bath, but the writer silvers small pieces in an ordinary glass developing dish, using but from two to four ounces in the bath. If the dish is used for developing, it should be washed thoroughly before using it for silvering, and it should not be used for the silvering bath unless it is glass. The great obstacle in the way of silvering paper in small quantities is the cost of the outfit at the start. But if small pieces are silvered at a time, not a very large or expensive outfit is needed. A glass developing dish the size of the largest print you would want, a hydrometer, half an ounce of nitrate of silver, and some albumen paper, are all that is needed at the start. Cut the albumen paper into pieces of the size required, and place where they will stay flat. In a four-ounce bottle put 200 grains of nitrate of silver, and fill up with distilled water; when dissolved, filter it into the glass dish, the bottom of which should be covered, from  $\frac{1}{4}$  to  $\frac{1}{2}$  of an inch, with the liquid. See that no particle of dirt gets on the surface, and then float a piece of paper, face down, on the bath; it will curl up at first, but will lay back in place as soon as it becomes damp. Lift up the corners, and prick any air-bubbles that may be between the paper and bath, and let the paper float about three minutes; then remove it, draining off any excess of liquid, and place between pieces of white blotting paper. Now, if these small pieces are hung up to dry, as are the full sheets, they will curl terribly, and roll up so as to be awkward to

handle in printing. A simple method of keeping them flat while drying is to lay them down on a smooth board, and tack a couple of strips of wood so as to nip the ends, as in Fig. 4. If well

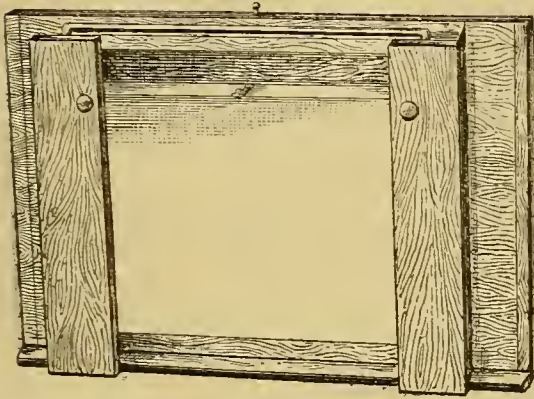


FIG. 1.—FRAMEWORK TO ADAPT SMALL PLATE-HOLDERS TO LARGER CAMERAS

but is slower in its action. After silvering all the paper required, return the bath to the bottle, and set in bright sunlight. The impurities will be thrown down by the action of the light, and can be filtered out when the bath is wanted for use again. In Mr. Vever's excellent articles on photography, in the First Series of *AMATEUR WORK*, are given full directions for using and caring for the silvered bath. The above hint is given, because many have an idea that silvering is a more difficult process than it really is, and that the only way of doing it is to silver whole sheets, as the professional operator does. Fuming, printing, and toning is carried out, of course, the same as with other papers.

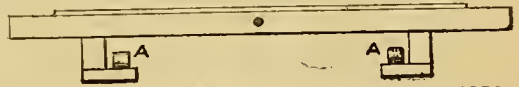


FIG. 2.—SECTION OF FIG. 1, LOOKING DOWNWARDS; A A, CURVED BRASS SPRINGS.

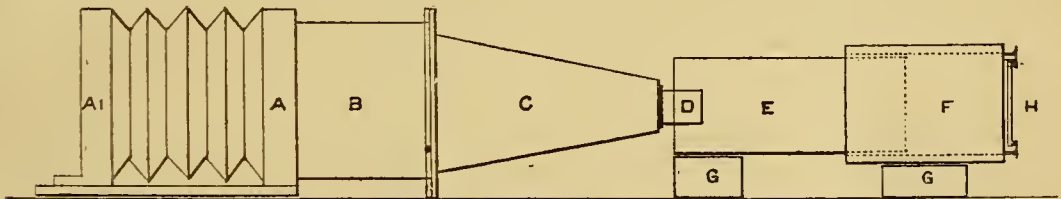


FIG. 3.—SIMPLE ARRANGEMENT FOR ENLARGING.

blotted, they will dry in ten or fifteen minutes, and will not curl badly if held down this way. An amount of paper large enough to print all that could be handled in a day, could be silvered the evening before. The hydrometer is necessary to keep up the strength of the bath, which, for ordinary negatives, should be about 50 grains of silver to the ounce. One advantage of silvering at home is that the bath can be varied in strength to suit the negative. Thin negatives require more silver, and dense ones need less; so, with the aid of the hydrometer, the bath being so small, it can be strengthened or weakened to suit very readily. Stains on the hands are frequent, to be sure, as a disadvantage; but these can be easily removed by first wetting with water, and then rubbing a piece of cyanide of potassium over them. Do not use this, however, if the hands are cut or bruised, as it is very poisonous. Hypo will remove fresh stains,

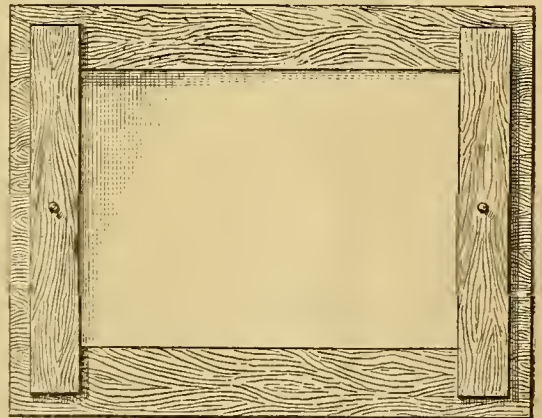


FIG. 4.—METHOD OF DRYING SENSITIZED PAPER WITHOUT CURLING.

Several formulæ are given in the handbooks for toning and changing the colour of blue prints. These change the prints to various shades of green and brown; but a different



shade from any yet described can be given to a blue print, by immersing it for a moment in a bath containing a small amount each of hypo and pyro mixed. Do not make it too strong, and have a dish of clean water at hand, to stop the action if too rapid. It will give the print a greenish, coppery colour, which is quite pleasing to the eye. The amount of hypo and pyro to be used can be best learned by experimenting. Some proportions will make the print a deep brown, while others will leave it, as above described, a coppery green. What the chemical change is, or how permanent the print is after being so treated, is not known to the writer, but the hint may furnish a new field for experimenting to some who are interested in blue prints.

**GREASE FOR BOOTS.**—Dr. Alexander Zoroastroff, of Belostok, emphatically recommends to all military men, sportsmen, and others, a grease for boots which is said to prevent sore feet entirely, and so protects pedestrians from the whole train of familiar affections caused by that minor accident. The ointment is made of four parts of lard, four parts of olive-oil, and one part of caoutchouc—raw rubber—which are melted together on a slow fire. Having moistened the sole of the boot with water, the inventor warms the boot in a stove or before a fire, and then smears it over with the compound. The boot is said to become soft, pliable, shining, waterproof, and even more durable.

**REMOVING OLD PAINT** by scraping or burning it off is extremely laborious, and too slow for general purposes. A more thorough and expeditious way is by chemical process, using for that purpose a solution of soda and quicklime in equal proportions. The solution may be made as follows: The soda is dissolved in water, the lime is then added, and the solution is applied with a brush to the old paint. A few moments are sufficient to remove the coats of paint, which may be washed off with hot water. The oldest paint may be removed by a paste of the soda and quicklime. The wood should afterwards be washed with vinegar or an acid solution before repainting, to remove all traces of the alkali.

## HOW TO MAKE AN ELECTRICAL DANCING NIGGER.

By GREGORIE EDOUIN BEY.



AM somewhat cosmopolitan in my opinions, as my name would seem to imply. Although a man may have a black skin and woolly hair, I do not regard him as an inferior creature. "A man's a man for a' that." Therefore, if I choose a coloured gentleman for my subject, and call this working model a nigger, I do so because such gentlemen have a supreme contempt for drapery when residing in their own country, and my model would be seriously incumbered with an excess of the same badge of civilisation.

In my travels through Old England I have had to take shelter for the night in lonely cottages by the wayside, far away from villages and towns. In such cottages the winter evenings are long and dreary in the absence of some source of amusement to pass the time away. Many such a long evening have I seen brightened by the skill of a local artist, who has succeeded in manufacturing a marionette out of a few bits of wood and wire, and, with this, acted the part of a dancing nigger. The nigger has been held by a back stay in the left hand over a platform of thin wood, manipulated with the right hand to keep time with a tune played on "the homely whistle"; and this bit of child's play with a toy, has often caused much mirth by the "ingle side."

I now propose to elevate this into the position of an electric toy, and show how it may be made to dance by the aid of electricity.

As some of my readers may not know how to make the model figure, I herewith give directions for making it. The figure may be of any size and height, but I recommend the height of seven inches as being most convenient. The doll (for it is nothing else) may be carved out of wood to the form of a negro, an Irishman, a Highlander, a sailor, or any other specimen of the human race, and may be painted and draped to suit the fancy of the artist. In the matter of clothing, much care must be



exercised, as excess in this may spoil the action of the model's nether extremities. If the figure is intended to represent a negro, a pair of loose drawers, coming down to just below the knee-joints, will be all the clothing needed. If the figure is to represent an Irishman, it should have a tall hat, a swallow-tail coat with long tails down to the heels, and a pair of yellow breeches down to the knees. The lower parts of the legs must then be carved and painted to represent boots and stockings. But,

now, as to the doll itself. The trunk is made of wood as in an ordinary wooden doll. The arms and the legs are loosely jointed with wire, so as to allow free action in all directions, but the wires should be hidden as much as possible by being buried in the wood, in imitation ball and socket joints, or covered with some loose-fitting flexible drapery. The figure will be held by a curved wire passing into the trunk at the nape of the neck, and from this a wire must pass down through the trunk to the thigh joints, where it

must be linked with wires passing through the thighs to the knees, and these, in turn, linked to wires passing through the lower extremities to the feet. The pair of wires ending in the feet should be bent forward and flattened, to form

soles for the feet, or else attached to metal soles on the boots. It will now be seen that this system of wires is intended to convey the electric current through the figure, and thus make its

own contact breaker by means of the contact of its feet with the metallic platform beneath. If, however, the skill of the amateur is not equal to the task of neatly jointing the figure's legs by means of linked wires, he may content himself with jointed limbs only, without any regard to electric connections. In

this case we shall have to arrange a separate contact breaker, as will be shown further on.

As the dancing abilities of the doll will be affected by the articulation of its joints, we will give these a little attention before we proceed further. In the home-made dancing figures I have seen by cottage firesides in the country, the artist first carves the trunk, or gets one of a wooden doll. He then drives two bent pins in the lower extremity of the trunk, at about  $\frac{1}{2}$  inch apart, to form supports to the legs.

He next carves out

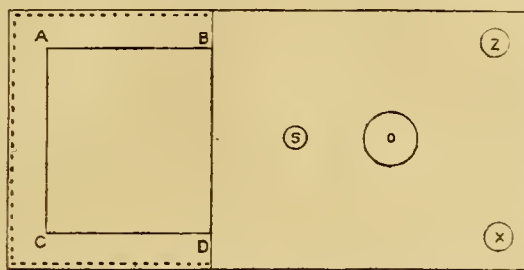


FIG. 1.—PLAN OF BOX LID; A, B, C, D, OUTLINE OF PLAT-FORM; O, POSITION OF SUPPORT FOR FIGURE; S, POSITION OF CONTACT SCREW; Z, X, POSITION OF BINDING SCREWS.

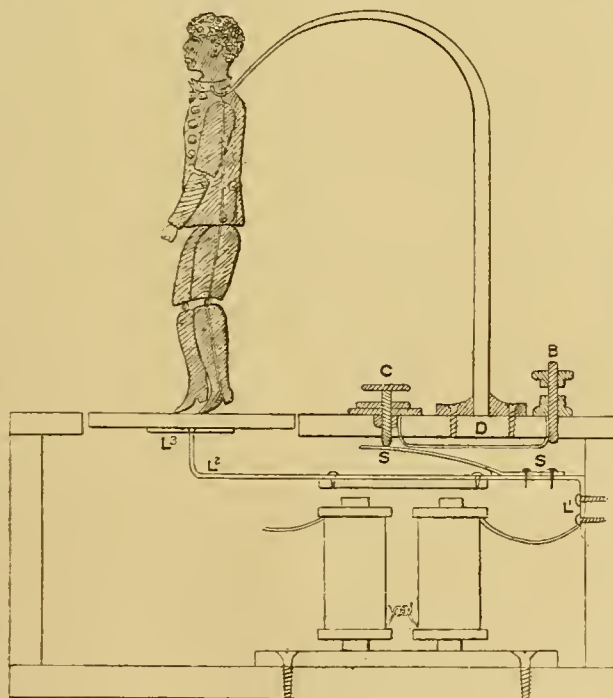


FIG. 2.—SECTION OF BOX, FIGURE, AND ELECTRIC FITTINGS; A, ARMATURE; B, BINDING SCREW; C, CONTACT STUD; D, SUPPORT FOR FIGURE; L, L, L, SPRING LEVER FOR PLATFORM; S, S, CONTACT SPRING OF LEVER.

the upper parts of the legs, and links these, by means of bent pins, to the bent pins in the trunk. The lower parts of the thighs are then hollowed out to form cups, and into these are driven two more bent pins. Much

care is taken in carving the lower part of the legs so as to ensure a shapely pair of calves, and shapely feet, for on the pose of the feet depends the dancing—heel and toe action of the figure. The upper part of these extremities, to form the knees, are nicely rounded to fit in the cups of the thighs, and both are neatly linked together with bent pins. The thigh joints are concealed beneath a short skirt, or in a pair of loose drawers made of thin material. If the arms of the figure are loosely jointed in a similar manner, they are also thrown about whilst dancing, and thus give a semblance of life to the motions. Of course, it must be understood that the legs must be exactly balanced, and be of exactly the same length.

The figure completed, we will now turn our attention to the electric part of the apparatus.

The electric works will be hidden under the platform on which the figure dances. This platform and all its accessories may be made to resemble the stage of a theatre, and should then be tastefully made and draped. The figure may be mounted on the lid of a box, and this fitted to contain the works. A small cigar box may be utilised for the purpose if thought desirable. The first thing to be done is to fit up the platform. If a box is selected, a part of the lid must be cut out as shown on the plan (Fig. 1), from A to D. The part marked by dots must be secured to the box, and, as this will form the border of the platform, it should be suitably ornamented. The remaining two-thirds of the lid may be screwed down when all the works have been fixed in the box. The lettered circles on this part, as marked on the plan, indicate the position of the fittings. The platform on which the figure dances will occupy the space enclosed by the lines A B O D. It will not be advisable to use the wood cut out from this space, as it will be too heavy for a platform. The best material for this, if a separate contact stud is used, is a piece of good cardboard or of papier-mâché. If the figure itself is intended to act as its own contact breaker, the platform must be of thin sheet metal, such as sheet tin, zinc, copper, or brass. It should fit the space fairly well, but must not touch the sides at any point.

Now for the inside fittings. First we shall require an electro-magnet, such as those used in the manufacture of electric bells. The size of this magnet should be governed by that of the figure—a large and heavy figure requiring a larger magnet than a small doll; but taking the height of the doll at about 7 or 8 inches, or under, the following dimensions will be found suitable:—Diameter of cores,  $\frac{3}{8}$  inch; length of cores,  $1\frac{1}{4}$  inches; diameter of bobbin,  $1\frac{1}{8}$  inches; each bobbin filled with No. 26 silk-covered copper wire. I presume that every reader knows how to wind the wire on these bobbins, and connect up the ends, as there have been an abundance of hints on how to do such things as these in back numbers of *AMATEUR WORK*. If at all unequal to the task of bell magnet construction, let me say that these can be bought ready made and wound from any dealer in electrical sundries. The magnet should be fixed to the bottom of the box in the centre of one end, as shown at Fig. 2.

The armature and lever of the platform will now engage our attention. The armature must be of soft iron; length, 3 inches; breadth,  $\frac{5}{8}$  inch; thickness,  $\frac{1}{8}$  inch. This must be fixed to the lever in the position shown at A (Fig. 2), by means of two small brass rivets passing through armature and lever. The lever of the platform should be made of a piece of thin spring brass,  $\frac{5}{8}$  inch in width, and long enough to reach from the back end of the box to the centre of the platform, after being bent, as shown at L L L. One end of this spring lever must be bent at right angles, and pierced with two holes for screws, as shown at L<sup>2</sup>. The other end must have two bends, one at L<sup>2</sup>, to bring this end high enough to reach the under surface of the platform, and the other at L<sup>1</sup> to form a support for the platform. This bend may be fastened to a metal platform by solder or rivets, or to a cardboard platform by glue or by rivets. Before fastening this spring lever to the end of the box at L<sup>1</sup>, we must fix another small curved spring to its upper part, as shown at s s, by means of small rivets or solder. This will form an elastic spring for the contact breaker, and also give elasticity to the spring lever. If used as a contact breaker,

it must be furnished with a speck of platinum on the spot where it will come in contact with the contact screw above. The lever, thus furnished, must now be fixed in position, so as to bring the armature  $\frac{1}{2}$  inch above the poles of the electro-magnet cores. If a little out either way, the error can be corrected by bending it a little at L L. To this angle, also, one of the wires from the electro-magnet must be fastened. This is done by stripping the end of its silk covering, and clipping it under the bracket between the two screws.

The back end of the box lid must now be fitted with a contact stud in the position shown at s (Fig. 1), and at c (Fig. 2); a curved support for the doll in the position shown at o (Fig. 1), and d (Fig. 2); and a pair of binding screws in the positions shown at z and x, on Fig. 1, and shown by b, at Fig. 2.

The contact stud is simply a brass screw  $\frac{1}{8}$  inch diameter, such as those employed in clamps for battery plates. The end of this screw must be tipped with a bit of platinum wire. It will be held in the lid by a brass nut sunk in the lid of the box, and secured thereto by two small brass screws. It will be advisable also to provide a lock nut, to facilitate adjustment, and prevent the screw from jarring loose. If this stud is to be used as the sole contact stud of the electric works, we must fasten a short piece of silk-covered No. 20 copper wire under the nut; carry this to the underside of the lid, and then fasten it to one of the binding screws, as shown at Fig. 2.

The support for the doll is merely a piece of  $\frac{1}{8}$ -inch brass wire, fixed in a brass foot, as shown at d (Fig. 2). The upper part must be filed to a long taper, and curved to form a spring. All this, together with the springs attached to the platform, is necessary to give the required elasticity to the dancing figure. The end of this curved wire must be curved upward slightly where it enters the centre of the back between the shoulders of the figure, and should there engage with the connecting linked wires when the figure is intended to act as its own contact breaker. In this case it is not necessary to convey a covered wire from the stud, c, to one of the binding screws, but a wire must be

conveyed from the brass foot, d, instead, to one of the binding screws. If the figure is not to be thus placed in the electric circuit, it will only be necessary to fix the end of the curved support in the back of the doll. I have given a rough outline of this figure, for the purpose of showing these connections, but not in any way to indicate the artistic treatment of the subject.

The binding screws should be of the well-known telegraph pattern, shown in section at b (Fig. 2), and sold at 3d. or 4d. each. If provided with an extra nut beneath, this will be found convenient for attaching the wires. One wire from the electro-magnet will go to one of the binding screws; the other has been already indicated.

This little apparatus may be worked, for short entertainments, with current from two or three pint Leclanché cells in series. If used for long entertainments, it will be advisable to use two or three pint bichromate or chromic acid cells. The vigour of the figure's action will be increased by adding to the number of cells in series, and allowing a fuller play of the spring lever by loosening the adjusting screw, c. If the dancing becomes in any way monotonous from the regular action of the electric contact, it will be advisable to add a little variety to the entertainment by interposing a Morse key in the circuit, or the push of an electric bell. By such means as these the motions of the figure may be placed under the control of a performer at a distance. The connecting wires in all cases should not be finer than No. 20.

In conclusion, I may just throw out a hint that all electric connections and a part of the curved support may be concealed by a judicious use of stage scenery and surroundings, and even the platform itself be painted to resemble a carpet.

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BLACK VARNISH suitable for covering places where a japanned surface has been injured or scratched.—Fine lamp black or ivory black, thoroughly mixed with copal varnish. The black must be in fine powder, and it would mix the more readily if made into a pasty mass with turpentine.



## SASH MAKING.

By FAUST.

## VI.—FORCING FRAME — GREENHOUSE SASHES — HANDY WAY OF CONSTRUCTING A GLASS ROOF.

ONE of the commonest forms of sash used in the garden is that with which a forcing frame is covered. It is easily made, as there is no necessity for any moulding to be run on the framing or bars, it being simply checked to receive the glass on the upper side. Fig. 43 shows how such a sash is put together. The sole should be about  $1\frac{1}{2}$  inches wider than the rest of the framing, and the depth of the glass check thinner; this allows the glass to come to the foot of the sash, and so permits the rain water to run freely off. One of the sash bars should be mortised through both sole and top rail, to give firmness to the sash, and if made in longer lengths than that shown, every fourth bar should have the tenons right through; the other bars only require to be let in about 1 inch, the glass check part being cut to slip over the sole, as shown in Fig. 44.

Fig. 45 is a rough sketch of an ordinary lean-to greenhouse, such as may be erected in any garden having a piece of blank wall; it is very easy of construction, especially if no mouldings be run on the bars or framing. The framing for the lower part can be of  $3\frac{1}{2}$ -inch by 2-inch stuff, the lower part being filled in with  $\frac{5}{8}$ -inch match-boarding, put on diagonally, and having the joints beaded or, preferably, V-jointed. This lower framing is half-checked together, narrow fillets being put round the openings to nail the match-boarding to; the fillets should be kept well back from the front, so as to give the boarding the appearance of a sunk panel (see

Fig. 46). The side and roof sashes are made each in one length; the side sash simply rests on the lower framing, to which it is nailed. The roof sash rests on top of the side sash at the front, and at the back, or wall side, upon a strip of wood firmly fixed to the wall at the required height; this strip of wood should be 6 inches wide and 1 inch thick. The details of these points, and the required bevels of the edges of side and roof sashes, can be seen on reference to Fig. 46, which gives a complete section of the house.

If it is desired that any of the panes in the side should open, you must put in, at the required places, a pair of thicker sash bars, checked for glass on one side only. The opening sashes are made to fit between these bars, and are hinged at the top edge; when open they are held in position by iron straps, with the usual hole and pin arrangement. The mode of hinging these opening

panes is shown in Fig. 46.

The end of the house must be framed up for the door, and the way to make it will be found by a reference to the paper on "French Casement Windows," where a similar door is shown. The bevels for the top part of the sash above the door must be got by drawing down on a board, as explained in the article on "Circular Sashes"; only in this case, as the sash would require a very large board to lay down a full-sized drawing on, it may be drawn to scale, and the sizes and bevels taken from it. The sash for the closed end can be made in one piece, the drawing being done in a similar manner.

In glazing the roof the glass should not be carried right up to the top of the sash, a space of three or four inches being left for ventilation; over this space a board is put to throw off the rain, it is raised above the glass at the front edge by being placed on bevelled strips of wood which are nailed down on the upper end of the sash bars (see Fig. 46). In houses of this



FIG. 58.

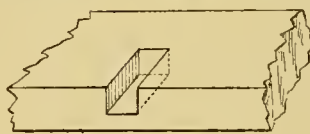


FIG. 57.

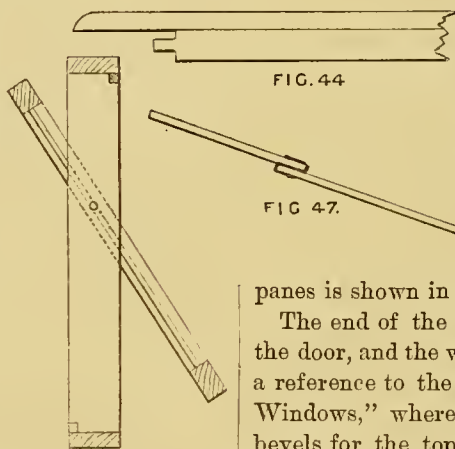
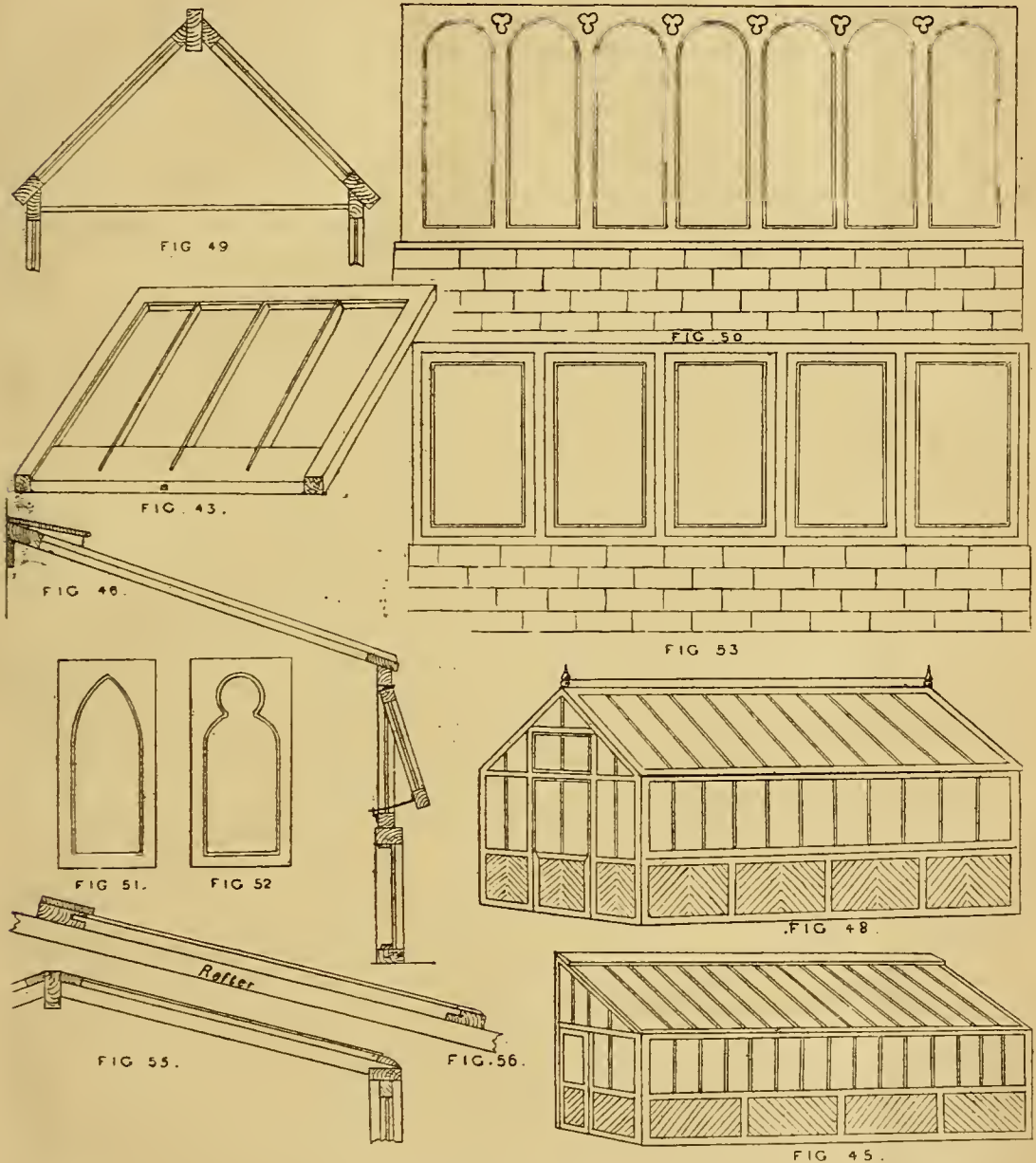


FIG. 54.

FIG. 44.

FIG. 47.



## DESCRIPTION OF FIGURES.

FIG. 43.—COMMON FORCING FRAME SASH.

FIG. 44.—END OF SASH BAR FOR DITTO.

FIG. 45.—LEAN-TO GREENHOUSE.

FIG. 46.—SECTION OF LEAN-TO GREENHOUSE.

FIG. 47.—MODE OF SECURING GLASS.

FIG. 48.—DOUBLE ROOF GREENHOUSE.

FIG. 49.—SECTION OF ROOF OF DITTO.

FIG. 50.—CIRCULAR TOPPED SIDE SASHES FOR GREENHOUSE.

FIGS. 51, 52.—ALTERNATIVE STYLE OF SASH LEADS.

FIG. 53.—SIDE OF GREENHOUSE WITH OPENING SASHES.

FIG. 54.—SECTION OF OPENING SASH.

FIG. 55.—SECTION OF ROOF WITH RAFTERS.

FIG. 56.—SECTION OF EASY FORM OF SKYLIGHT.

FIG. 57.—CHECK FOR BOTTOM END OF SASH BAR IN DITTO.

FIG. 58.—SECTION OF SASH BAR.

description the glass is generally put in in short lengths; it is much easier handled, and easier to replace when broken, than when the panes are in one piece, not to speak of the economy. I may here remark that a friend of mine, who is an enthusiastic amateur photographer, has utilised—I am afraid to say how many—dozens of his spoilt plates in glazing a home-made greenhouse. I do not mean to give this as an instance of economy, for it was anything but cheap glazing if we consider what the plates cost, but it shows how apparently waste material may sometimes be usefully employed. In glazing, commence at the bottom of the opening and work upwards, letting each piece of glass overlap the previous piece about  $\frac{3}{4}$  inch, keeping it in position by means of a small piece of zinc bent somewhat into the shape of S; these can be had at any glaziers, or can be made by the worker himself from any odd scraps of zinc that he may have by him. This piece of metal keeps the glass from slipping down while the putty is soft, and is shown in Fig. 47, which is a section of the roof glass, although the same remarks apply equally to the sides.

The interior fittings of the greenhouse may be left to the builder's own taste, as each worker will, no doubt, have different requirements.

A larger house is shown at Fig. 48, and differs from it in having double sides and roof, so that it may stand in any desired part of the garden. The general construction is the same as the one already described, with a few minor differences. The match-boarding at the bottom part is cut so as to meet at the centre of each panel, the door is in the centre of the end, and has a hinged fanlight above it; the roof sashes have a ridge board running between them, which gives additional strength, and may be cut out, if desired, to any ornamental design on the top edge. Two  $\frac{3}{4}$ -inch iron rods should run across the house to bind it together, and counteract the outward thrust of the roof lights, which, in a light building of this kind, is apt to bend out the sides. These rods should divide the length of the house into three equal parts. A section is shown at Fig. 49.

A very effective style of sash for the sides of a greenhouse may be easily made, as shown in

Fig. 50. The sashes are framed the whole length of the sides, and have a wide top rail, which is cut out to circles, trefoil holes being cut to lighten the dead wood between them, and also to serve as ventilators, being closed by a sliding or hinged board in the inside. The form of the sash tops may be varied, and can be Gothic, as in Fig. 51, or cut, as in Fig. 52. These forms are best suited for large greenhouses, in which case they are generally laid upon a dwarf brick wall, and are set into a framing of about 6 inches by 2 inches. This framing is shown in Fig. 53, which is for square sashes, each of which opens. The sashes are made to fit the openings, and are hung with pivot hinges, which are kept a little nearer to the top than the bottom, as in Fig. 54.

The roofs of these larger houses are usually made with a ridge board and rafters, upon which the roof sashes rest, as the sash itself, without such support, would be too weak to carry its own weight; these rafters should be about 4 feet apart, and of 6 inch by 2 inch wood. For the sake of appearance they can be moulded on the under edge. Fig. 55 shows a section of a roof of this kind, the joints at the top of which are generally covered with a strip of lead, to keep out the rain; on top of this an ornamental ridge is put, which may be either of wood or light ornamental cast iron.

A very useful and handy way of constructing a glass roof that is supported by rafters is shown at Fig. 56; it does away with the necessity for framing up a sash, and is much quicker made. The top piece, which corresponds to the top rail of an ordinary roof sash, is mortised for the sash bars (Fig. 58) at the required widths; it is then nailed firmly on its place on the rafters, and the sole piece is also firmly fixed in its place at the bottom, having checks cut in it to correspond with the mortises in the top piece (Fig. 57). The sash bars, having all been tenoned to fit the top rail, are now fitted in their places one by one, and secured at the bottom by checking and nailing to the sole piece. This form of skylight can be very quickly put together, and is finished, after glazing, by a piece of wood being nailed on top of the top rail, and allowed to project about an



inch over the glass; this serves to throw off the rain water clear of the top joints.

In closing this series of papers on sash making, I feel that of necessity many of the peculiar details and mystifying joints may be difficult of mastery by many who attempt the work; and if so, I shall be ever ready to endeavour to clear up any doubtful point that may trouble the mind or perplex the brain of the anxious worker, if he will ask for the necessary help through the medium of "Amateurs in Council."

## HOW TO MAKE A BOW SAW.

By ED. C. ROE, Jun.

**A**CTUATED by the belief that one of the most pleasurable things a mechanic thoroughly interested in his work can do, is to construct for his own use those tools which come within his province. Apart from this, however, I think there is not one worker in wood who, if he be professional, has not found the absolute necessity, or if an amateur, has not discovered the desirability of possessing such a tool as I shall endeavour to describe, more especially as the tendency now is towards ornamental work when dealing with brackets or other articles of furniture, etc.

The frame of which dimensions are given is not full-sized, but personally it has proved of an extremely useful size, and therefore, speaking from experience, I should not recommend, at any rate, for amateur usage a larger one.

The saw itself is 12 inches long, and, of course, can be purchased at any respectable tool warehouse. Regarding the selection of material to be used—beech will be found good; birch, lancewood, or ash may be used with advantage; be careful, whatever material is used, that the grain is fairly straight. It is a matter of regret that full-size sketches cannot be given, so as to ensure the proper curves being set out; but we must bow to our worthy editor and the inevitable, and content ourselves with half full-size drawings.

The thickness of the frame proper is at its thickest part  $\frac{7}{8}$  inch finished, and if a piece of

stuff be obtained about 4 inches wide and  $13\frac{1}{2}$  inches long, it will be found to cut out both the side pieces. Before cutting them to shape it is advisable to mortise for the cross-bar as per dotted lines, leaving the shoulder square for future fitting.

It may, I think, be taken as a foregone conclusion that proper means are not to hand with which to cut the sides out, and therefore we must content ourselves with the use of a keyhole or pad saw, which will answer our present purpose. After cutting out, each requires to be thinned down towards one end, so as to give about  $\frac{5}{8}$  of an inch at the cross-bar mortise, so as to correspond in thickness with the bar, and  $\frac{7}{16}$  at the top or hooked end. The shaping is best done with spokeshave, rasp, and judicious use of glasspaper; but do take care that wherever a sharp arris or edge occurs, not to convert it into a nice rounded edge. The lower end is finished off to an edge, as per sketch B.

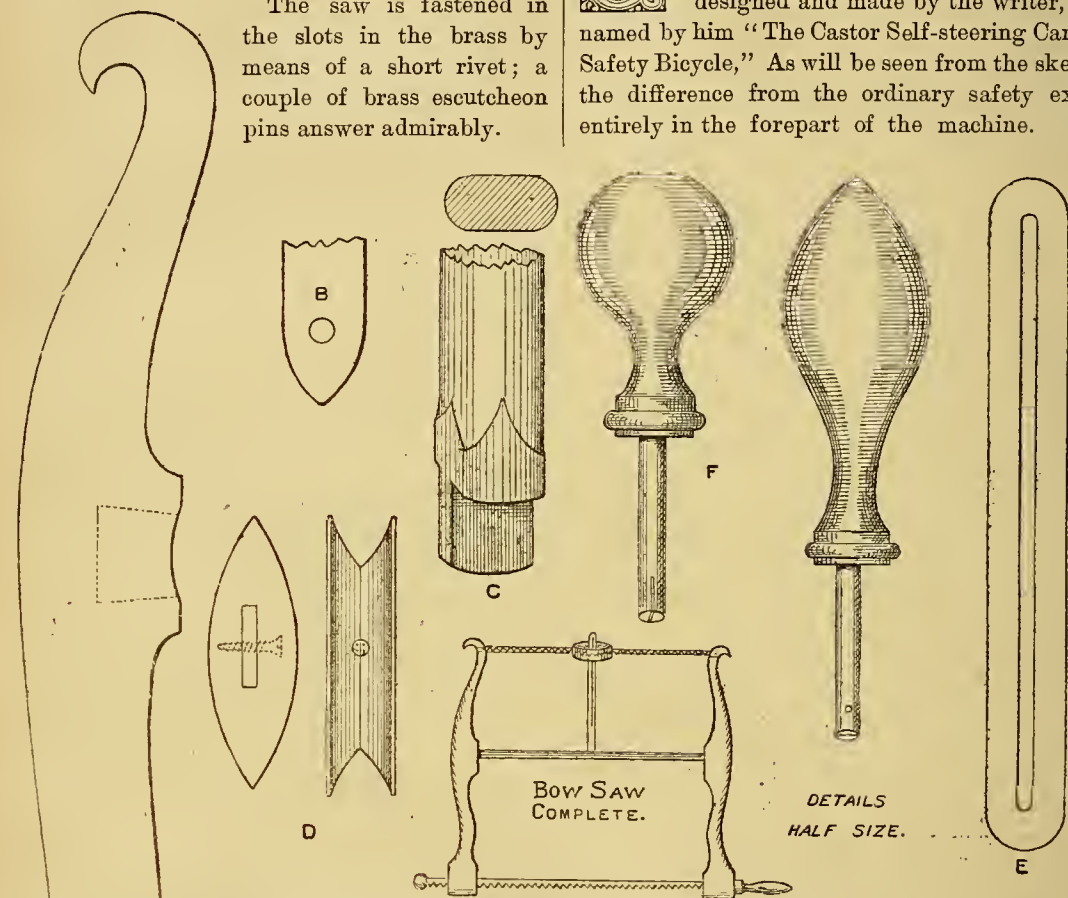
The cross-bar now needs attention; it is out of  $\frac{5}{8} \times \frac{7}{8}$  inch finished size,  $12\frac{3}{8}$  between the shoulders, giving a total length of  $13\frac{7}{8}$  inches. Before rounding, the mortise for the straining or cross-bar must be attended to;  $\frac{1}{4}$  of an inch will be found sufficiently wide for mortise. The tenons on ends should be carefully cut, and the shoulders rounded off to segment of a circle, as per sketches A and C, and then fitted to the mortises in side accurately; when this is satisfactorily accomplished, we may round off to section given at C, dying away each end, as also shown in same sketch.

The provision made for straining now claims our attention. I do not think that any amount of descriptive letterpress can make the sketches more conclusive. The rod E should slide easily but not loosely in the mortise in D, a screw, as shown, being put through to prevent the rod sliding out. The rod E is  $\frac{7}{8} \times \frac{1}{8}$  inch, and has a slot cut in it a bare  $\frac{1}{4}$  inch wide. The best method to use for straining is to have 10 or 12 turns round of thin venetian cord, not blind cord, such as is often sold being nothing more than common string covered.

Sketches of the handles used are given at F, for the benefit of those who possess a lathe, but it is generally advisable to purchase these with

the saw. When obtained, the holes for their reception may be bored in the side pieces; these require to be bored very carefully, and it is advisable to bore trial holes in a waste piece of stuff first, as the brass pegs must fit the holes exactly.

The saw is fastened in the slots in the brass by means of a short rivet; a couple of brass escutcheon pins answer admirably.



We can now put the results of our labour together, and see if all is well, and afterwards polish, or cause to be polished, what I hope will prove to the constructor, as it has proved to me, one of the most useful tools in my box, and one which has oftentimes more than repaid the small amount of trouble and expense involved in its construction.

## A NEW SAFETY BICYCLE.

By A. STEVENSON.

THE sketch, Fig. 1, is a side view of a safety bicycle of an entirely new type, designed and made by the writer, and named by him "The Castor Self-steering Carrier Safety Bicycle." As will be seen from the sketch, the difference from the ordinary safety exists entirely in the forepart of the machine. The

front fork stands vertically, and curves backwards instead of forwards, as in the ordinary safety. The steering centres are also vertical, and are in front, instead of behind the fork head; and in this and the backward curve of the fork is involved the self-steering property of the machine. The steering wheel, placed thus, will, as does a castor, find its own centre when the machine is in motion, without bringing the handle bar into requisition for steering purposes. If, for example, you made the handle bar a fixture with the frame, and used it only for balancing and pulling, and left the front wheel

entirely free of all control, that wheel will run straight in the centre, so long as the machine is balanced upright. Moreover, if the rider leans to the right or left, and cants the machine over, the centre of gravity will be changed, and the machine will turn to whichever side it is thus canted.

Although the machine has this property, it has also a steering connection with the handle bar, which will be described in due course. The

carrying a cube of 16 inches; any sized parcel less than this, as indicated by the dotted lines, may be carried by putting on a smaller carrying rack.

Now for a description of the machine, in so far as that is necessary. The rear wheel is 30 inches diameter, and the steering wheel 24 inches diameter. As the building of wheels has been fully described in *AMATEUR WORK*, they need not be further mentioned here.

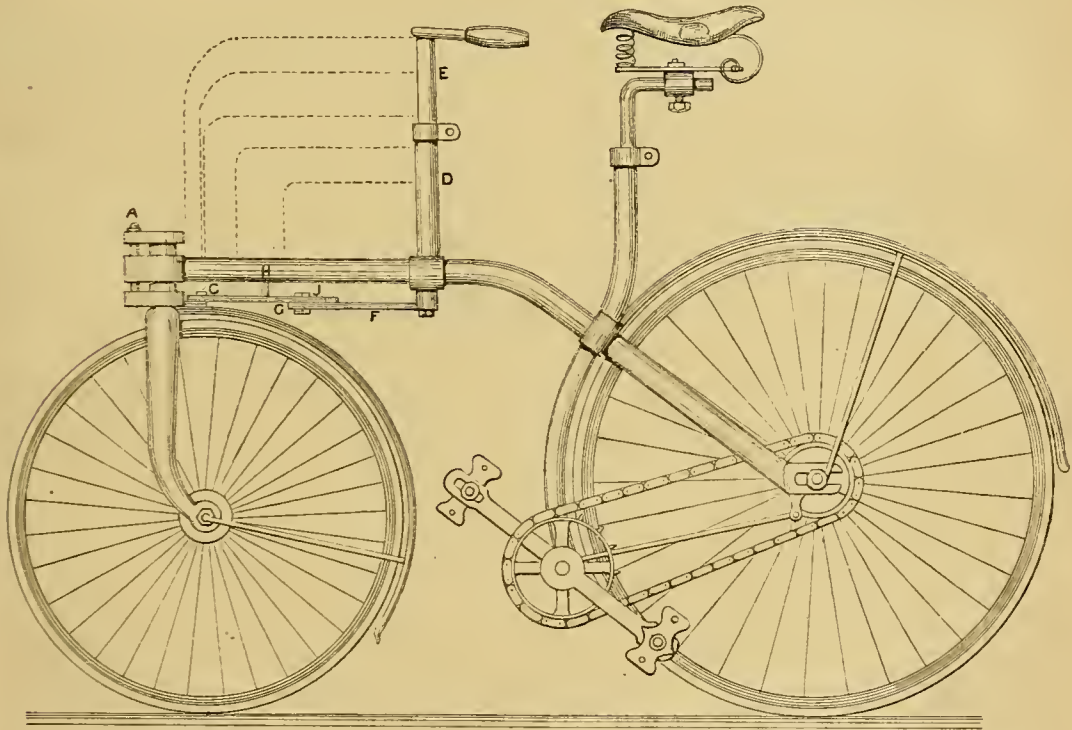


FIG. 1.—SIDE VIEW OF CARRIER SAFETY BICYCLE.

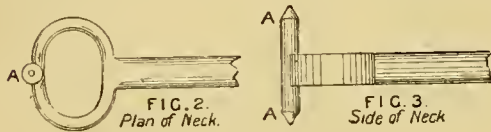
aim of the maker has been to have the machine so far self-steering as that the handle bar may be left to itself when on a good road with plenty of room, and not constantly grasped for steering purposes as in the ordinary safety, the relief thus afforded to the hands being a great advantage. Then from the construction of the frame great facility is given for luggage carrying. The rectangular space over the backbone and in front of the handle bar post is the space designed for luggage-carrying purposes. Here may be fitted a carrying rack capable of

The rear part of the frame, to a point immediately behind the handle bar post, is identical with the cross frame already described in "Safety Bicycle Construction," and needs no further comment. At the point behind the handle bar post, the backbone tube is bent, and runs forward level to the top of the front fork. On the fore-end of the backbone is an oval ring (see Figs. 2 and 3), with the steering centres on the forward side and in line with the backbone (see A, Figs. 2 and 3). The steering tube attached to the fork head comes up through this ring, and its oval



form allows sufficient side play in steering. The two steering lugs are brazed to the tube in the usual way, but the lower lug has a short arm projecting backwards (see Fig. 4). This arm, *B*, is 2 inches long, and has a short upright pin, *c*, the purpose of which will be seen shortly.

The handle bar post (*D*, Fig. 1), is rigid with the backbone, and the tube, *E*, attached to the handle bar, enters a little way into the tube *D*. The tube *E* has inside it again a solid rod, which passes right down through the backbone; the lower end has keyed on it an arm (*F*, Fig. 6) very much resembling a bicycle crank; the for-



ward end of the arm, *F*, has a pin, *J*, similar to the pin, *c*, in Fig. 4.

Now a connection is effected between this arm and the steering lug by a link (*G*, Fig. 5). This link is pinned to the underside of the backbone at the point *H*, and is allowed to turn freely on its pin. The link (*G*, Fig. 5) has a slot on each end  $1\frac{1}{2}$  inches long, and wide enough to admit the pins *c* and *J*.

When the handle bar is turned, the arm *F* is moved sideways, and with it the link, the forward end of which, acting upon the pin *c*, turns the fork and its wheel in the same direction with the handle bar, the pins being free to slide backwards and forwards in the slots in the link *G*.

I think the arrangement as described, with the aid of the diagrams, cannot fail to be clearly understood by the intelligent mechanic, especially if he has studied the articles on bicycle making in the last Volume.

I have only to say this is no theoretical notion. I have tried the machine, with the handle bar fixed and the connecting link removed, and could ride with perfect confidence where the road was free of stones, and where nothing existed to diverge the wheel from its centre.

Fig. 1 is a view of left side of the machine.

It may be objected by some that the machine does not look so smart as the ordinary safety; this, however, is only a matter of sight usage. Its luggage-carrying facilities over the ordinary Safety or any other form of bicycle will be patent to all. A luggage-carrying rack would have two clips on the backbone, and one on the post *D*.

In the detail diagrams, Figs. 2 and 3 are the neck ring and steering centres, with part of backbone.

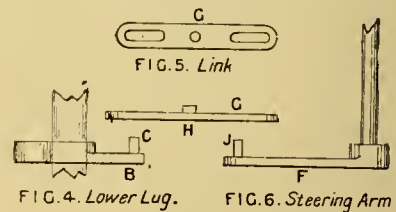
Fig. 4, the lug immediately above the fork-head, and which receives the lower steering centre. The short arm, *B*, is made one with this lug.

Fig. 6, *F* is the steering arm attached to the vertical rod, connecting with the handle bar; and

Fig. 5, the link of connection between fork and handle bar, and completes the steering arrangement.

The plated parts are:—Handle bar, cranks, hubs, seat-pin, arm *F*, link *G*, head-pin *A*, and all nuts and washers.

The steering-arm *F*, link *G*, lower lug (Fig. 4), and the ring-neck, Figs. 2 and 3, cannot be got



in the market; consequently, I had them done in cast-steel from my own patterns.

If any mechanical reader of *AMATEUR WORK* desires to make a machine of this type, I will let him have either the patterns or castings from them.

Any new reader, who has not had the benefit of back numbers of *AMATEUR WORK*, is referred to my articles on "Safety Bicycle Construction" in Vol. I. (New Series), where he will find full instructions, with illustrations, which will, in conjunction with the above description, enable him to make A NEW SAFETY BICYCLE.

## THE AMATEUR DEMONSTRATOR.

## LIGHT.

By O. BECKERLEGGE.

VI. — POLARISATION (*continued*) — POLARISING BY THIN PLATES OF GLASS — EXPERIMENTS WITH MICA — WITH CRYSTALLISING SALTS — POLARISING LANTERN — FIGURES MADE WITH MICA FILMS — TESTING SPECTACLES — GLASS PLATES UNDER MOLECULAR STRAIN.



THE following is a plan I have adopted, and it gives splendid results:—Square up a piece of wood 2 inches on each side, and, say, 6 inches long. Using a square, scribe a line across one end, and from that draw a line at an angle of  $26^\circ$  up the side; from the upper end of this draw a line with a square across the other side opposite to the first one marked, and join the ends with another line at the same angle as the first. With a fine saw cut off and plane up the angles to the line. Now round up the wood, and take it to a tinplate-worker, and get a tube made with one end cut off to the angle given. An oval ring of wire must be soldered to the inside of the tube, so that a plate of glass laid on it shall be at the same angle as our mould. Another tube must be made to go over this, spring tight, with the end at the same angle and with a similar ledge to hold plates of glass. Out of stiff cardboard cut an oval that will nicely slip into the tube and rest on the ledge. The first one should be wide enough so that it would not slip through; those that are laid on it may with advantage be made a little smaller. The glazier who cut the glass for me persuaded me to have the edges bevelled to fit the tube. I was foolish enough to consent, and had to pay about five times more than the glass was worth. In each tube place about eight pieces of glass, which should be of the thinnest and whitest window glass; though, if thin plate glass could be procured, I think I should prefer it. What really is wanted, is glass free from colour and veins or striæ, so as to suffer as little loss of light as possible. Now place one tube in the other (Fig. 28), so that the two sets of glass lie parallel with each other; direct the tube towards

a source of light, and the only difference will be seen is a certain amount of light lost by passing through the plates of glass. Now turn round one of the tubes, and we shall find the light grow less and less until the tube is turned one quarter round, or the plates stand perpendicular to each other, when if a certain number of plates are used the light will be extinguished. Continue to turn the tube; the light will increase to its maximum when the plates are turned half-way round. Still keep turning till three-quarters round, and the light is quenched the second time, gaining its full brilliancy the second time when it has reached its starting-point. We thus find that, like two plates of tourmaline, these plates of glass have two poles, one when the full light is transmitted, and one where the vibrations are quenched. Let us now place a film of mica, not too thin, between the two tubes, and according to its thickness we shall find colour. Select a part that gives the most brilliant effect, and cut out a circle to place in the outer tube; now insert the smaller, and direct the instrument towards a diffused light, and we shall have a gorgeous spectacle. Turn the analyser, as we will call the smaller tube, and we shall find the colours change at every revolution, giving place to their complementary. I happen to have selected a portion which gives a beautiful field of blue, crossed by a broad band of richest crimson.

That the light from the blue sky is polarised, is easily seen; for if we use the analyser only, directing it against the sky with a film of mica in front of it, we shall obtain colour as before. The same will be observed by viewing light reflected from water, polished wood, etc., only we must remember that each body has its own polarising angle. If the amateur will make two cells on the same principle, one to place beneath the stage of his microscope, and another to fit into the tube, he will have really a very efficient polariscope, though of course not so effective as a pair of Nicol prisms, as the films of glass will absorb much more light. In this instance, instead of using window glass, the thin glass used for covering micro mounts should be used; and instead of using a film of mica, a much thinner film of selenite, mounted on a micro slide, is used. Place on a slide a saturated

solution of almost any salt, such as chlorate of potash, and as the solution crystallises, the feathery forms will glow with the richest colours. Each salt will manifest particular features, so that articles can be tested by this means to see if they have been adulterated. For example, the starch of potatoes can be detected if mixed with the starch of corn. By following out the foregoing experiments, the amateur will be able to demonstrate most of the principal phenomena in connection with the polarisation of light. Sometimes it is desirable to demonstrate before a number at once, when we shall have to avail ourselves of the lantern. The neatest arrangement, and one within the reach of the amateur, is one described in the *English Mechanic* some years ago. Fig. 29: A A are the ordinary condensers of a lantern, fitted into a tube screwed into the front B; c is an elbowed tube with the lower corner cut off, which leaves an oval opening. To fit this, a tin box must be made; in the bottom of it lay a piece of black velvet, and on this, say, 12 plates of the whitest window glass, flat and free from striæ. E is an ordinary focussing lens, in front of which is fixed a tube carrying either a Nicol prism for analyser, or a bundle of glass films, as before described. To project the figure on a screen, the lantern must be turned at an angle. It must be observed when working with plates of glass, that all glass does not polarise at the same angle. There is a mean angle, but for different samples there are variations (at least, this has been the writer's experience); and in making the last-named instrument, it would be advisable to test the angle which gives the best results—demon-

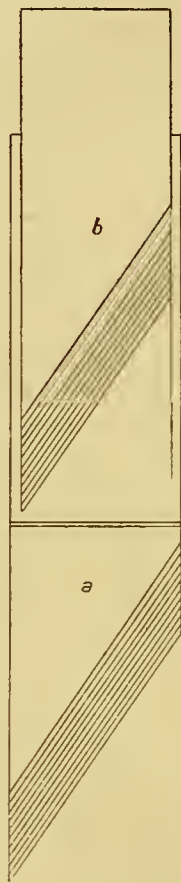


FIG. 28.—POLARISING BY THIN PLATES OF GLASS; a, POLARISER; b, ANALYSER.

strate for yourself. It must be remembered that a larger number of plates may be used for polarising by reflection than transmission. In the latter case, the fewest possible are used, as each plate absorbs so much light; and whilst it is desirable to have the light polarised, it is also desirable to lose as little as possible; by reflection, up to a certain point, the larger the number of plates employed, the greater will be the amount of light that is both polarised and reflected. Very

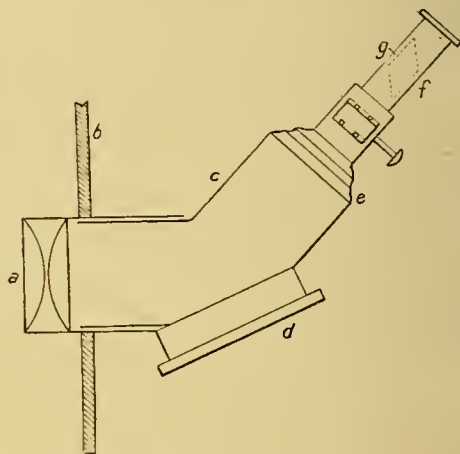


FIG. 29.—LANTERN POLARISCOPE.

pretty figures may be designed on the mica by making it thinner or thicker. If a fairly thick piece of mica is taken, and a circular hollow is ground in the centre so as to resemble a plano-concave lens, then it will give coloured rings, which will change places as we rotate the analyser; at each half revolution the colours will change to their complementary. At the two other points they will overlap each other, and consequently will give white light. As mica readily cleaves, crosses, stars, etc., can be easily made; the design can be traced with a sharp penknife, and the films taken off. By such simple means, with patience and care, beautiful designs may be made. If we resort to grinding, the surface of the mica will be naturally roughened. This can be remedied by mounting the specimen on Canada balsam, between thin glasses, when transparency will be restored. By the means of polarised light the amateur may determine whether the pair of spectacles which



he bought of that respectable travelling optician is "pebble," as was said, or only common glass; whether it was worth the half-guinea which was first asked, or rather was not dear at the half-crown for which it was eventually sold as it was "to you." If the spectacles are crystal, they will give colour; if common glass, they will not, unless by chance they are made of glass not properly annealed. Any lump of clear glass will almost be sure to polarise, as it is not likely to be properly annealed. In the act of annealing, the molecules arrange themselves according to the nature of the substance, and the ether surrounding the molecules is of equal elasticity in all directions; if, however, the molecules have been arrested and fixed, they are under tension in one direction. Often such glass breaks without visible cause; consequently the ether is freer to vibrate in one direction than the other; hence the two sides of the beam of light are differently affected or polarised. Blocks of glass can be procured under this tension; they are not good to make, but the amateur should try. Procure some bits of the thickest plate-glass possible, say  $\frac{1}{2}$  inch, and get them cut into one inch squares. In a piece of stout sheet iron—say  $\frac{1}{4}$  inch thick, or thicker, if possible—have a  $\frac{3}{4}$ -inch hole bored. Place the bit of glass on a piece of clean smooth slate, and put it into a clear fire; do it carefully, so that no dust shall fall upon the glass. Watch carefully so that the glass does not begin to melt. At a point before it reaches a pasty state, withdraw it, and with a pipe stem quickly, though gently, push it on the cold iron, so that the hole will come in the centre of the plate. The consequence will be that the iron will rapidly conduct the heat away from the edges, whilst the centre will cool slowly, with the result that the molecules will so arrange themselves that there will be a great internal strain. That the amateur will meet with failures must be taken for granted; but, without doubt, he will find some beautiful specimens. If glass is bent or put under pressure and viewed, the same results will be manifest—the molecules will be of necessity closer in one direction than another, which will produce corresponding effect on the ether surrounding them. The student must not

think the subject is exhausted; but it is hoped that sufficient has been said to give an insight into the subject, and help the amateur demonstrator in this most fascinating branch of physics. We shall deal with the spectroscope in a separate article.

## THE AMATEUR'S GARDEN: HOW TO MAKE IT PAY.

By T. H. E. J. HARRIS.

### II.



QUARTER of an acre of garden land and upwards, attached to suburban villadom, is a condition of things seldom to be met with, and, when found, deservedly worthy of note. But in country districts, not alone is the quarter-acre patch often belonging to a cottage rented at two-and-sixpence a week, but the cottager who pays this rental will be first to grasp at one of the allotment gardens now so common throughout the country. And nowhere in England are grown better crops and richer produce than from the garden of one of the bold English peasantry. Those who so glibly assert that quarter-acres, or acres, do not, as holdings, pay, may be asked why the countryman is so eager to rent, and to spend all his leisure time on the cultivation of, the soil if it did not profit him to do so—if the result of his labour was not a satisfactory one? A very eminent medical authority (Dr. Abernethy) once stated his opinion that we all of us ate and drank too much, and to another of his rich patients he gave the prescription—"Live on sixpence a day, and earn it." Many of us, those who can get at it, most emphatically do eat too much—and preferably of the expensive or animal food, wasted to excess in nine English homes out of ten—and not sufficient of the vegetable, home-grown food, to keep the *mens sana in corpore sano*; and then we perforce indulge in another piece of extravagance, and keep a doctor on the premises, all the while lamenting that we are "very ill, far worse than we imagine."

Some do nothing without figures—no under-

taking can be gone into without recourse to the primary rules of arithmetic. In this age of competitive examination and the diffusion of knowledge under difficulties, it is not a difficult problem to calculate "how much it will pay" per acre. To plant a row of potatoes 50 feet long will require half a peck of seed. Plenty of good sound seed can be bought from six to nine shillings a sack. If the soil be fairly looked after, each perch of land should yield a sack of potatoes. The average countryman and his family more than half live from the produce of the garden. The average townsman takes his subsistence (?) from the "coffee tavern" or the "dining rooms." Which is the stronger man of the two—which capable of most endurance?

Having solved the arithmetical problem, having ascertained the amount of the green-grocer's little account for stale matter, in too many instances only fit for the pig-trough, proceed to the quarter-acre or the acre patch, if happily possible, and lay it out for pleasure and profit. In the fall or early spring of the year fork the soil roughly, and plant, 5 feet apart each way, the earliest gooseberry which can be procured. Sprinkle a little stable manure, or soot, at the foot of each plant. Early gooseberries are valuable, and they thrive anywhere out of the smoke of a big city. One of the best varieties is "Berry's Early," and can be had direct from its sponsor, in Selling, near Faversham. There is nothing better than actual fact and experience from which to speak. A number of these "Earlies" were planted last February. Though only small bushes, each one (in the month of April) is literally crammed with berries. Between each row of bushes there will be room for two lines of strawberries, "Sir Joseph Paxton" by preference, and a row of potatoes. The first year the potatoes will pay the entire cost of planting, the second year the strawberries will be the main crop, the third year the leading crop will be gooseberries. About 15 feet apart plant down the middle of every third alley "Standard" apple, pear, plum, or cherry trees, and the plantation will be laid out on soundest lines for profit. If red currants be preferred to gooseberries, and the situation be warm and sunny, plant "Hudson's Prolific,"

taking care to prune the limbs of each bush down to about three eyes from the trunk; cut any very small shoots clean away, leaving the strong branches only to form the fruit-bearing bush, and as the fruit in reds always comes on the *old* wood, cut off each succeeding fall all the new growth excepting one "eye," which is left for increase. By this plan, the fruit is maintained in large bunches, instead of being indifferently scattered over a larger surface. Gooseberry-bushes should be cut in the fall, so that the middle of the bush be kept fairly open, and shoots which threaten to hang on the ground either removed entirely or cut to a few inches of the stem. All these cuttings should be tipped, two or three "eyes" removed from the lower end of the shoot, and then planted out as sets for the following year. If black currants be preferred in the plantation, and the situation be a shady one, select "Baldwin's" for a heavy crop of fine large fruit. These bushes will not require pruning when planted, but they may be "tipped" here and there, to make the growth uniform in appearance, and they should be set deep in the ground, that the side shoots which spring from the stem may be bedded in the soil, thus ensuring new wood springing readily from the roots of the bush. In blacks cut away, at the fall of the year, those shoots which are old, poor, or straggling, leaving the vigorous young wood for the fruit-bearing bush. There is a great art in tree or bush planting. In the case of the former, the hole should be quite 3 feet across, and 18 inches deep. Lighten the soil at bottom of the hole, and cutting away any tap root or large growth from which no small fibres spring, stand the tree in its place, and carefully pull out the young roots from their centre, and in the direction it is desired for them to grow; throw in three or four shovelfuls of earth while an assistant supports the tree, which should then receive three or four careful up and down shakes, so that the young root fibres may be well bedded in soft soil. When the hole has been three parts filled, heavily and firmly tread the earth all round, cast in the remainder of the soil, and again tread to securely fix the plant in its new home. In staking, bind the stake,



where it is to come in contact with the tree, with a piece of old canvas or a straw band, and secure with bass; anything rather than cocoa fibre. Prune all branches of trees before planting, cut out weak shoots, and leave, for a good crown, about three or four eyes on each branch. Bush planting is identical in treatment, except that the hole is necessarily of smaller dimensions, about 1 foot across, and 9 inches deep.

And now having the small holding and the crop therefrom, there remains one other query, "What will we do with it?" Many have heard of the Irishman's receipt for stone soup; some of us may not have tried it, despite the cookery school at Kensington. All that is necessary is a pot and some water, and a good-sized stone about as big as a piece of chalk; set the whole on the fire, and cook till done; but the flavour is improved by addition of a little pepper and salt, a few herbs, some onion, turnip, carrot, or potato, at choice, and—a small allowance of meat. It was remarked in an earlier paragraph that there was much waste and loss of animal tissue in the English housewife's cookery. If she will take a gallon saucepan, and half fill it with cold water, place therein one pound and a-half of leg of beef, *well minced*, not cut into chunks fit for feeding at the Zoo, add two onions, two carrots, two turnips, and a root of celery, all sliced, pepper and salt to taste, and *simmer, not boil for a moment*, for three hours, add thickening and a lump of burnt sugar, and there will be a dinner from the holding for six good trenchermen, the equal to which many in their most fervid dreams of appetite have never realised.

In this world it is fortunately given unto us to differ in opinion. Some prefer their quarter-acre of lawn tennis, or their flower beds, from which they may decorate the village church at high festivals. But the strawberry has its admirers, home-grown gooseberries at Whitsuntide possess a claim for many, and for a harvest festival, what prettier offering could the young ladies make than a tasteful adorning of the village pulpit with some choice prolific potatoes! Far more effective and natural than "hearing the parson pray and preach," sur-

rounded by a pile of half-quartern loaves, as was once the case in a rural district not a hundred miles from the "Lights of London Town."

But there will be no profit if it be too much trouble to do these things personally. A neighbour complained the other day that every cabbage he grew cost him sixpence. He employs a "gardener," an assistant to help the gardener, and a lad to help the assistant, somewhat after the manners and customs of our old friend, *Nouveau Riche, Esq.* He had made his pile, built himself a gorgeous red-brick house in the modified Queen Anne style of architecture, furnished it in the latest fashion by an eminent firm all the way from town; but the odour of the shop overpowered alike the newly French-polished mahogany and the violets which did their best to blossom in the outrageously-designed vessels allotted to their growth. This man, in his ignorance, would paint a lily if he could make it glitter like refined gold; but inferior to the lowest fungus, less wise than the common mushroom, he cannot "turn the nitrogen of the atmosphere into wholesome food within a night." Some growers, after a plantation of bushes has entered its third year, continue the growth of vegetables between the rows "to get as much off the ground as possible." If it be desired to "draw" the bushes, and to unduly impoverish the land, this system of cropping may be highly recommended. But those who desire their plantation maintained in full vitality, those who do not seek the produce of two rods of land from one rod of soil, such will not seek temporary gain at the expense of permanent injury.

In training wall trees it is always advisable not to nail to the walls, but to fasten wire netting behind the trees and against the walls, and train on the netting.

In conclusion, may I be allowed to express an earnest hope that what has been written may have the effect of inducing some readers to take up this branch of amateur work, than which I know of nothing that so well repays the labour expended upon it, not only from a monetary point of view, but in that which money cannot buy—health.



## HANDLING GOLD-LEAF.



HERE are probably few persons, except among painters and decorators, who know how to handle gold-leaf properly.

The first requirement is a smooth board, 8 inches wide and  $2\frac{1}{2}$  feet long. Upon this the book of leaf is to be laid, and the back of the leaves, where they are bound, cut with a knife or pair of shears, so as to leave each leaf separate. With a small piece of rag, wet with turpentine, the top layer of paper is to be rubbed over. Care should be used in applying the turpentine not to get the paper so wet that the turpentine will strike through to the second paper and stick them together. The first paper, when moistened, is to be raised and laid upon the board, so that the edge of the paper will extend a  $\frac{1}{2}$  inch or more over the edge of the board.

Do not lift any more leaves than will be necessary for the work to be done, as the turpentine will dry off and the leaf will not be so easy to handle or cut as when the paper is damp, or it will stick to the paper so that you cannot get it off. In using the outside leaf or cover, put it on while quite wet, or the leaf will not come off. The finish on the paper will stick the leaf and paper together, if allowed to dry.

In cutting, hold the paper in such a manner that the pieces will fall on the board with their ends extending over the edge  $\frac{1}{2}$  an inch, when they can be readily picked up by the thumb and forefinger. Old shears are better for cutting the leaf than new ones or those newly ground.

A VARNISH formed by dissolving orange shellac in 95 per cent. alcohol is indispensable for all kinds of electrical work, and for finishing wood and metal work. It may be readily coloured by the addition of pigments. For brown the red and black may be mixed; for purple the red and blue; for yellow, finely powdered yellow ochre or chrome yellow may be added; for a dead black varnish, alcohol, with a small percentage of shellac varnish added, mixed with calcined lampblack, answers an excellent purpose.

## TWO EASILY MADE BRACKETS.

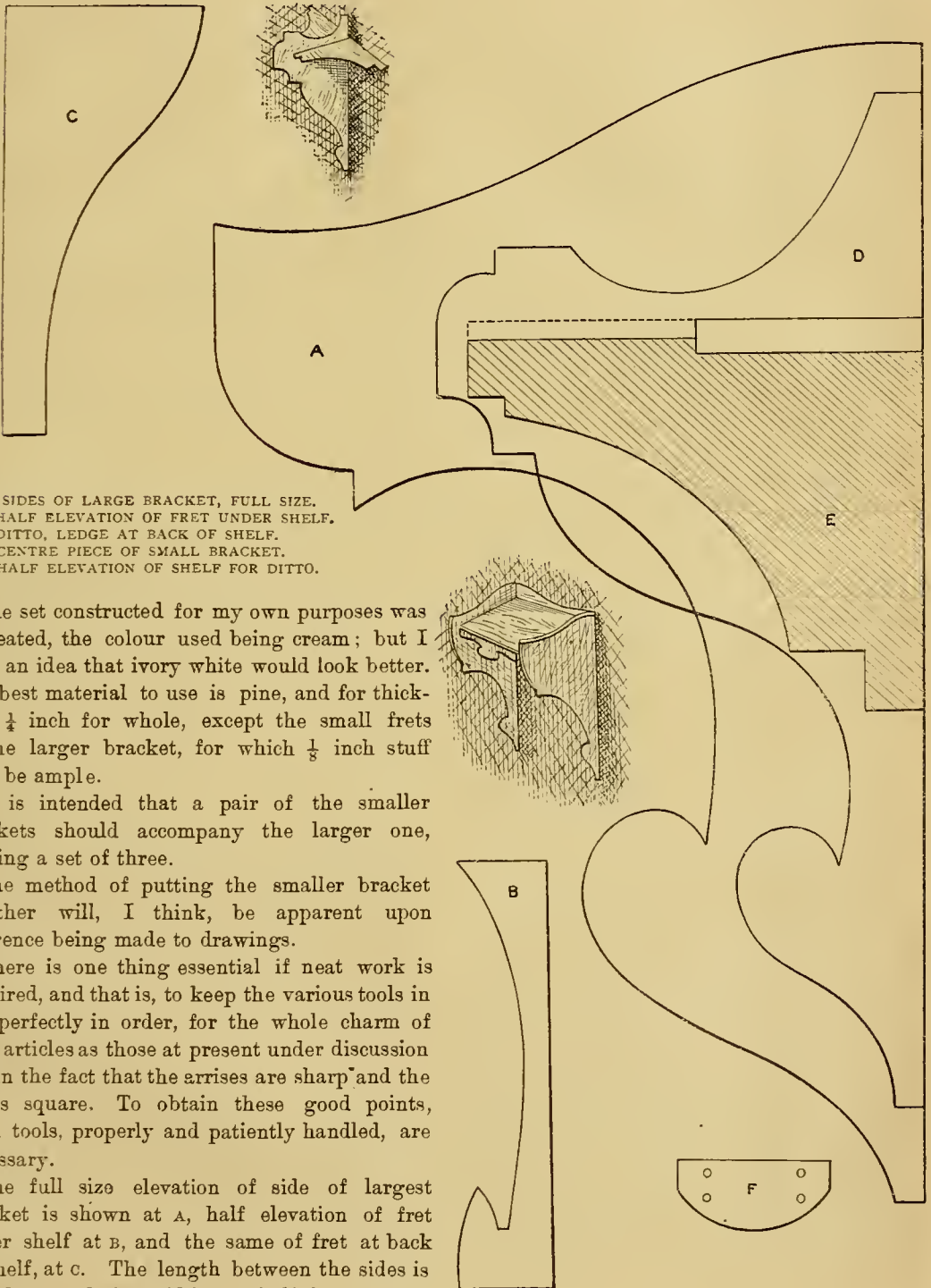
By ED. C. ROE, Jun.



SHORT time back it was my privilege to discuss the construction of a couple of simple brackets; and having reason to believe that such have proved useful, and also have probably met one of those many little wants often expressed, I venture to bring before you another pair of these articles, which often afford the means of filling up an odd and, perhaps, otherwise ugly corner; and certainly wherever placed, when nicely finished and judiciously hung, look well, and amply repay the trouble taken.

As before, these brackets were designed and made with the idea in view, that they should be enamelled. Now, the fault which often brings dissatisfaction to the worker, and disrepute upon the manufacturer, is that the surface is not sufficiently solid or glossy in appearance when finished; this is invariably the fault of the worker, and is generally caused by either of two things—namely, insufficient material is used for the purpose of stopping the suction, which annoying property all woods generally used possess, and secondly, that one coat is not given sufficient time to dry hard before another is applied. The first-named fault may be successfully overcome with certainty by the following means:—

Give a coat of patent knotting, which can be obtained at any oil and colour shop; apply carefully, and leave to dry, which it will do in about a quarter of an hour; then stop any nail-holes, or other defects there may be, with putty, and give a coat of thin lead colour; if priming is asked for, what is requisite will be supplied; let this stand all night, at least, and afterwards give a slight touch over with a piece of well-worn glasspaper, dust the work well, and then apply the enamel, using a flat brush of the description generally used for varnishing. Be careful not to get any fat edges, and be assiduous in keeping all dust from the work whilst wet. Do not attempt to handle until absolutely dry, and remember that patience is the essence of success. It is patience, and patience only, that will overcome the second fault mentioned, successfully.



A. SIDES OF LARGE BRACKET, FULL SIZE.  
 B. HALF ELEVATION OF FRET UNDER SHELF.  
 C. DITTO, LEDGE AT BACK OF SHELF.  
 D. CENTRE PIECE OF SMALL BRACKET.  
 E. HALF ELEVATION OF SHELF FOR DITTO.

The set constructed for my own purposes was so treated, the colour used being cream; but I have an idea that ivory white would look better. The best material to use is pine, and for thickness  $\frac{1}{4}$  inch for whole, except the small frets in the larger bracket, for which  $\frac{1}{8}$  inch stuff will be ample.

It is intended that a pair of the smaller brackets should accompany the larger one, making a set of three.

The method of putting the smaller bracket together will, I think, be apparent upon reference being made to drawings.

There is one thing essential if neat work is required, and that is, to keep the various tools in use perfectly in order, for the whole charm of such articles as those at present under discussion lies in the fact that the arrises are sharp and the edges square. To obtain these good points, keen tools, properly and patiently handled, are necessary.

The full size elevation of side of largest bracket is shown at A, half elevation of fret under shelf at B, and the same of fret at back on shelf, at C. The length between the sides is 5 inches, and the width of shelf is 4 inches.

The frets, as before mentioned, are  $\frac{1}{8}$  inch thick.

The centre piece of small bracket is shown at D, half elevation of shelf being indicated by cross-hatching at E.

Half inch or  $\frac{3}{8}$  inch brads are suitable to fix together, boring first with a fine bradawl. The method of hanging up the small brackets is provided by plates, as at F, the plate being fixed to the shelf, so as to bring the lower holes under same out of sight.

Further explanation I do not think necessary, and therefore leave the patient ones to construct the brackets, which, it is hoped, will fulfil the prediction made at the beginning of this paper.

## HINTS ON WOOD CARVING.

### AN OAK CABINET.

*By ROUGE DRAGON.*



**I**N a former article which I contributed to *AMATEUR WORK*, mention was made once or twice of an old oak cabinet of very simple construction, which I have before my eyes now as I write. It would be such a simple and interesting piece of work to carry out, and such a beautiful, as well as very useful, object when done, that I propose now to give exact measurements and directions, by which its counterpart might be constructed by anyone who has practised even the rudiments of carving in wood. I give a sketch of the front of the cabinet as it stands; the two doors are the only part of it that is decorated with carved patterns, with the exception of a narrow border which runs round the bottom of the two sides as well. But these doors have a great variety of decoration upon them; the panel design on the lower part of each is the one that I gave among the illustrations to my last article (in the January part, *i.e.*, p. 53 of the present volume), also one of the borders appeared then.

The size of each door is 35 inches by 16 inches, and the width of wood required for each border is about 3 inches. Each panel measures about 11 inches in height, by 10 in width; these panels should be carved on a

separate piece of oak, and the borders added to them, as a frame, afterwards. These borders must also be carved on single strips of oak, and should stand up about  $\frac{1}{2}$  inch above the panels when the whole is put together. This can be done in the ordinary way by a joiner, when all the carved decoration is finished.

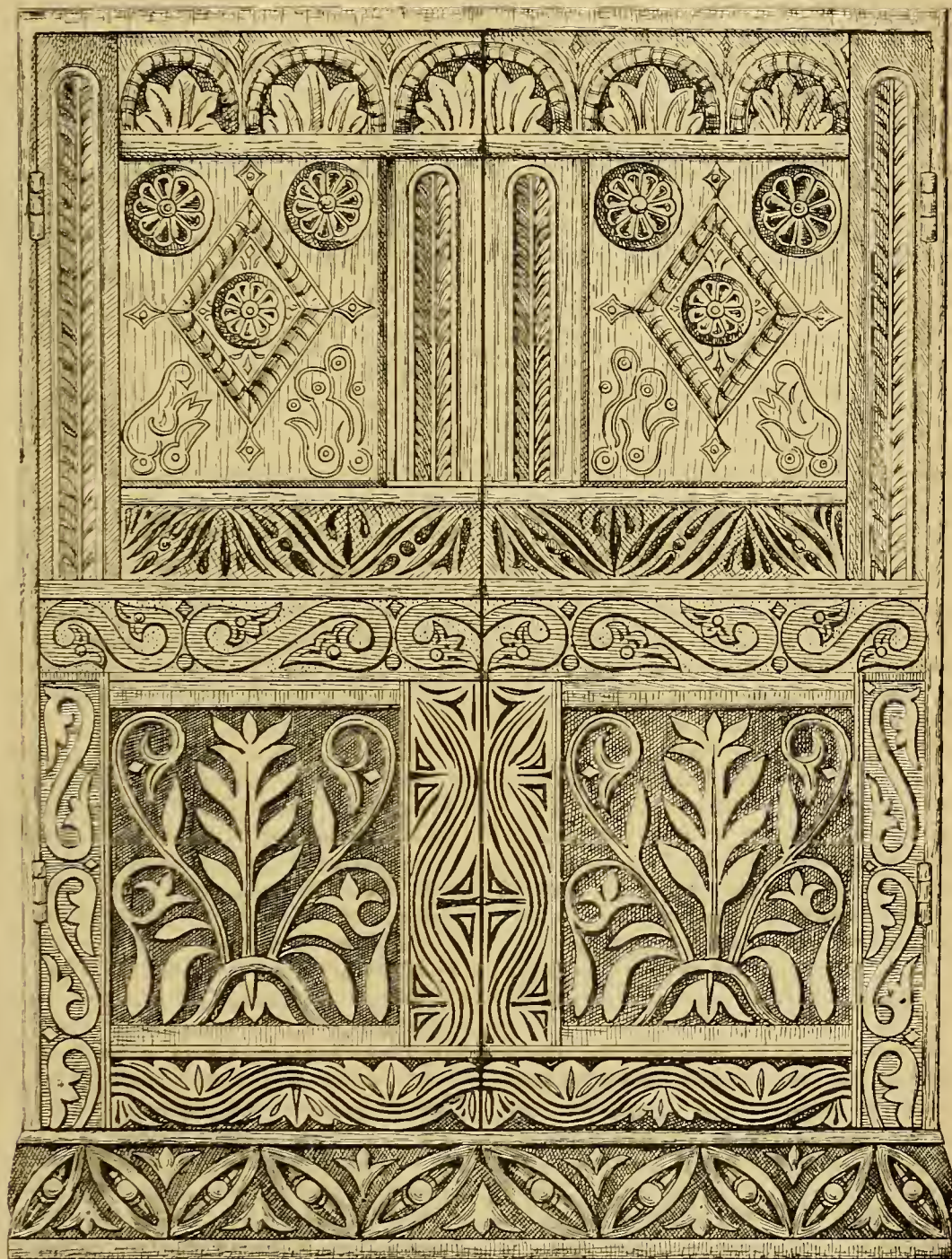
The back and sides of the cabinet are perfectly plain, the depth of the sides being  $12\frac{1}{2}$  inches. They may either be made of ordinary deal, stained brown (if the carved work is stained dark also), or of plain light oak. Two shelves could be put in, across the inside, and the whole thing is complete.

The model of which I am writing is a real piece of old furniture, and has the rich dark brown colour which only age can give to oak, and which is, so far, more satisfactory than any stains or polishing, or any of the devices that are used to make new work and wood have the appearance of the old. And thus it is impossible for any fresh piece of work, however well copied, and identical in treatment with that from which it is taken, to be quite such a beautiful object, or such an adornment to a room, as a genuine old example, which owes much of its beauty to the mellowing effect of time. Yet I prefer the modern piece of oak-carving to be left in its natural colour, instead of staining it dark, which is all very well for deal, or pine, and commoner woods. It will then gain every year in depth and richness of colour, which will be all its own, without any pretence at being what it is not. If the oak is rubbed occasionally with a soft, dry cloth, it will gain that polished appearance, in process of time, which is one of the characteristics of old work in oak, and by the absence of which we can generally tell a spurious piece of so-called "antique oak furniture."

I hope that the illustration I give of the front of the cabinet will be sufficiently clear to work from without any great difficulty; but there are one or two details in it, to which it may be as well to devote a little further explanation.

The circlet ornaments in the upper panel have first the background scooped down from the edge, up to the petals (for we may look upon it as a conventionalised flower), and the edges of each one of these are left high, and the inside





SKETCH OF OLD OAK CABINET.



part is cut out, so as to make each petal concave. The centre of each stands out as a high boss.

The wood between the lines of the diamond-shaped pattern is also scooped out into a hollow, and the bands cut across it with the V-tool ; the inside of it is flat, with the little designs cut upon it in outline, and the circular flower inside is carved in precisely the same way as the larger ones outside. The designs on the lower part of this panel are very curious, and I have nowhere come across anything like them in old carving ; they seem to have been suggested by a bird's head, and are most quaint and original. They are simply and broadly incised in the panel with the V-tool.

The long, straight borders on either side are very simply done, and will, I think, speak for themselves. Of the two patterns which run across in the centre, the upper one has the pattern scooped out, and the background left flat ; the lower has the background cut away and finished with a dotted punch, and the serpent-like design left flat, the little ornaments upon it just cut in outline.

The border down the left-hand side is also worked in the latter way ; in the one opposite to it, the pattern is again cut out, and also in the one below. The working of the lower panel shows the pattern left standing flat, not even rounded at the edges, and the background cut away and punched sparingly.

The piece of oak for the lowest border of all has to be prepared differently, for it is rounded outwards, and the carving has to be done upon this rounded surface. This forms a sort of projecting plinth, into which the whole cabinet is set, and it runs round the two sides as well as the front ; the door, of course, stops just above it.

The top of the cabinet is perfectly flat, like the sides and back, and the doors are fitted inside these, as the position of the hinges will show. The work may be finished off with a lock and key in the centre of the doors ; sometimes very beautiful old brass keyhole ornaments may be picked up for a shilling or two at a curiosity shop, and an ornamental brass head might be fitted on to the top of the key. Or, if a lock was not required, a decorated brass handle of

good design would harmonise well with the carved work.

I should like to add one other hint which, I think, will be of material assistance to amateur carvers, who often find a difficulty in fixing and arranging the wood so that it can be worked at comfortably, especially when the piece of oak to be carved upon is small, or a narrow strip, such as the borders in the piece of furniture I have been describing. In this case the carrying out of the work is much simplified if it is glued down first to a piece of deal, or some common wood, *larger* than the piece to be carved, which can then be fastened to the table with a clamp, so that the whole surface of the oak is free to be worked upon. If, in glueing them together, a piece of paper is put between the two surfaces of wood, it will be quite easy to separate them whenever it is required to do so.

This plan will, I think, render the carving upon small pieces or panels of wood, borders, etc., a much easier and pleasanter undertaking than if the oak itself is clamped down to the board, as it is then very apt to slip away from under the tool, and the screw requires to be moved two or three times in the course of the work, where it covers portions which have to be carved.

I may also, perhaps, be permitted to repeat my former advice, that the tools should be constantly sharpened, and their edges kept with the greatest care ; for it is impossible to turn out clean edges and well-cut sharp lines without the sharpest of chisels and gouges. And never, in a moment of inadvertence, let the hand rest, for ever so short a time, in *front* of the tool with which the other hand is working, or a very bad cut may be the result, though this cannot possibly happen, however much the tool may slip, if both hands are always behind it. If the wood is well screwed down, it ought to remain perfectly steady under the pressure of the tool.

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To FROST GLASS, make a clear solution of gum-arabic, then prepare a very strong solution of Epsom salts in hot water ; mix the two together, and, while warm, brush it over the glass, where it will crystallise and make a very pretty pattern.

## NOTES ON NOVELTIES.

By THE EDITOR.

*Britannia Company's New No. 2 Catalogue.*—The only fault I had to find with the Britannia Company's catalogues was that they were uncomfortably large. In the present catalogue, which is excellent in every way, the illustrations have been reduced in size, and the contents generally condensed into a smaller space, to the great convenience of the reader. Although reduced in size, space has been found for the introduction of several new features, such as carpenters' benches, tool chests with fittings, electrical instruments, etc., and the catalogue is now so perfect that it really leaves nothing to be desired except the cash with which to purchase the tempting goods therein described and illustrated; but even in that matter the Britannia Co. are prepared to meet their customers by means of a system of easy payments.



*Philip's Sun-dial.*—Messrs. George Philip and Son, 32, Fleet Street, London, E.C., have sent me one of their new portable sun-dials, of which the illustration gives an excellent idea. It is enclosed in a strong, cubical, cardboard box, to the top of which is fixed the base of the instrument, so that by the simple process of turning the lid or top of the box upside down the sun-dial is securely packed. In order to adjust it for use it is placed on a flat surface, so that the small leaden plummet, at the back of the instrument, hangs exactly over the metal pin, and by means of a compass, let into the lid, the box is set north and south. The lower end of the brass meridian is then fitted into the groove in the wooden support in such a way that the needle joining the two sides of the meridian is placed exactly against the figure representing the latitude of the place where it is being

used (thus for London  $51^{\circ}$ , for New York  $41^{\circ}$ , etc.). Solar time is indicated by the shadow of the wire, which joins the two sides of the brass meridian, falling upon the circle of figures. Upon one of the sides of the box is a table for connecting solar to civil time. It is a most ingenious and instructive little model, and would prove of great service in schools and colleges as a means of illustrating the principle of the sun-dial. The box containing the sun-dial may also be used as an exponent of the decimal system of reckoning measurement and weight. It measures one cubic decimetre, which contains one litre; if filled with water, the contents would weigh one kilogram, one-thousandth part of which weighs one gram, and measures one cubic centimetre. The instrument is sold complete for three shillings.

*Photogravure.*—Amateur photographers who aim at producing artistic work, and at the same time desire a permanence in their productions which is too frequently wanting in silver printing, will be delighted with an illustrated pamphlet by W. T. Wilkinson, just published by Hliffe and Son, 3, St. Bride Street, E.C. (price 1s. 6d.), giving information how to etch photogravure plates, and to print off impressions therefrom. The pamphlet is clearly written, and by its aid amateurs will have no difficulty in etching their own plates, and in the frontispiece to the pamphlet they will find a specimen of the kind of work that can be produced by the process.

*The Encyclopædia of Photography.*—Messrs. Hliffe and Son send me the second part of the "Encyclopædia of Photography," now publishing in sixpenny monthly parts. The name of the author, Walter E. Woodbury, is a guarantee of the excellence of the work. It is freely illustrated, and if I may judge of the whole by this part, I should say that photographers who neglect this opportunity of providing themselves with a reliable book of reference on everything relating to matters photographic, will regret it.

*Nonpareil Sanitary Paint.*—Mr. M. Guppy, Watlington Street, Reading, who is a practical decorator and colourist, has sent me samples of the Nonpareil Sanitary Paint, which is a speciality of his. He claims for it that it is non-poisonous, that it has more body than the best old white lead paints, and being ground extremely fine, it spreads easily and will cover nearly twice as much surface as lead paints. Being of great smoothness, it admits of the highest artistic treatment and finish. The question where to buy really good ready-mixed paint is a somewhat important one to amateurs, who are often unable, when they get a bad material, to decide with any certainty whether the fault lies with the paint or in their method of applying it. On one occasion I bought a tin of so-called paint from a small general store, and found, when I came to use it, that the contents of the tin had not even gone through the pretence of grinding, and when applied to the work, gave it the appearance of having been sanded. The samples sent by Mr. Guppy are a delicate pink tint and fawn colour. Having given both a careful trial, I can fully confirm the statements made by the manufacturer. The paint spreads with great ease, and covers well, and the surface is all that can be desired. It is sold in tins at 6d. and 1s. 3d., or in 7 lb. cans at 4s. 3d., including the can.



## AMATEURS IN COUNCIL.

For "*Instructions to Contributors and Correspondents*," see p. 46 of this Vol., or Part 13 (*New Series*), p. 46.

### Fitting Lathe Chucks.

E. H. MOORE writes:—"I send you a method I have followed for fitting some of my lathe chucks; and as it is easily carried out and answers well

the reverse way brings the washer to bear against the base of the chuck, and releases it from the taper hole without any knocking.

"For the larger chucks a nut is screwed to mandrel nose, first putting on a brass washer or two, B B, turned up and faced truly, to occupy the unthreaded portion of the mandrel nose; the nut then beds up firmly and truly against the washers. The thread is then turned out sufficiently to allow the

should be reversed again, and a slight cut taken over the face of it, when it should be all right.

"This nut is then brazed or soldered to a faced-up disc of iron, put again on the lathe, and turned up as required to mount American or other chucks. Two American chucks I have fitted in this way run quite truly.

"Manganese steel nuts,  $1\frac{1}{2}$  inches, can be procured at Pfeils and Co. at about 7d. each; smaller sizes would, of course be cheaper.

"The bit chuck as illustrated is a useful one, and can be procured for 2s. 6d. at the Army and Navy Stores; it is sold with cylindrical stem, left soft for turning or fitting as required. If what I have written is not clear, I should be glad to answer questions, or send chucks to inspect.

"I have found the nuts, as a rule, rather tight for my lathe, but I have a thread tap which I pass through, and this at once puts them right."

### Where to Purchase Blank Nuts.

R. R.—You can get blank nuts ready for tapping from Messrs. W. Barwell and Son, Hockley Nut Works, Birmingham.—J. H.

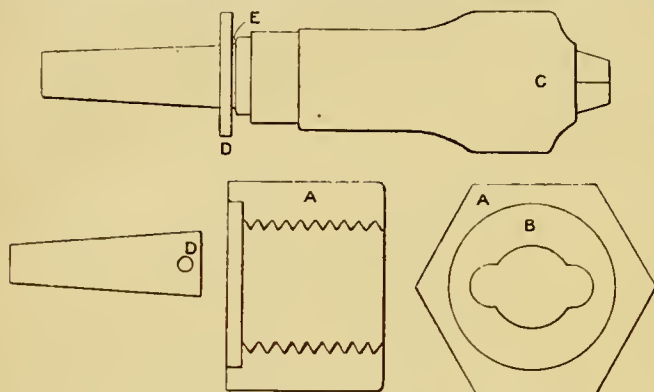


FIG. 1.—METHOD OF FITTING SMALL CHUCKS; A,  $1\frac{1}{2}$  INCH NUT; B, TURNED WASHER; C, BIT CHUCK; D, FRENCH NAIL; E, SPACE BETWEEN FRENCH NAIL AND BACK OF CHUCK WHERE WASHER WORKS ROUND.

(at least, this is my experience), it may be of service to brother amateurs.

"First, for fitting small chucks: A is a manganese steel nut  $1\frac{1}{2}$  thread, corresponding to the mandrel nose of lathe—a 5-inch by the Britannia Co. This nut is screwed on to the mandrel, first slipping on a large brass washer or two for it to bed against; a recess is then turned out to receive an ordinary iron washer, B, the washer being turned and filed as shown in Fig. 1; the washer is then brazed or soldered into recess. The stem of chuck to be fitted is turned to fit taper hole in mandrel nose, and a hole drilled through the stem at right angles, to receive a stout piece of steel wire, or piece of French nail, to be made a tight fit.

"In fixing the chuck, the nut, as fitted, is partly screwed on to the mandrel nose, and the stem of chuck inserted in taper hole from the front, the projecting piece of wire or French nail engaging inside the washer. All being nearly home, a slight turn of the nut sets the chuck up tight and true, and it will remain fixed, even should the back poppet be not in use. Turning the nut

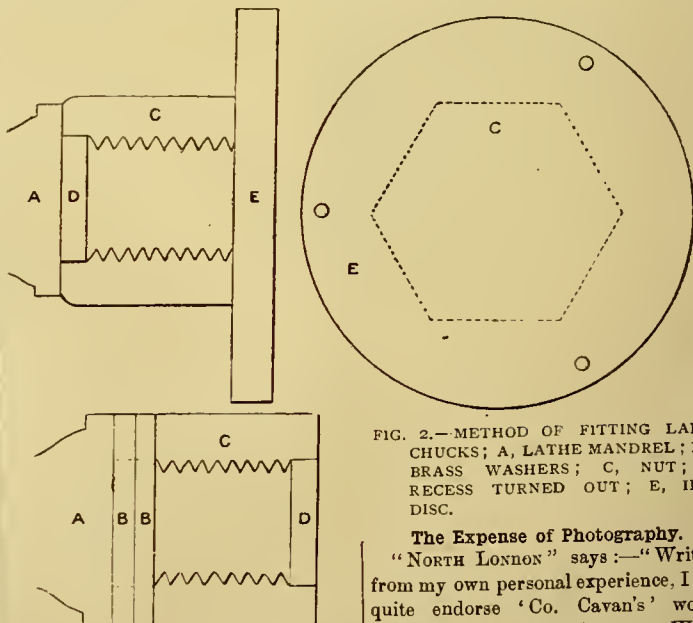


FIG. 2.—METHOD OF FITTING LARGE CHUCKS; A, LATHE MANDREL; B B, BRASS WASHERS; C, NUT; D, RECESS TURNED OUT; E, IRON DISC.

### The Expense of Photography.

"NORTH LONDON" says:—"Writing from my own personal experience, I can quite endorse 'Co. Cavan's' words (page 431). I have AMATEUR WORK from the commencement, and from instructions and drawings therein have made a  $\frac{1}{4}$ -plate camera, dark slide

nut when reversed and screwed again on the mandrel to bed well and truly home; should it not bed quite truly, it

tripod, dishes, rack, plate-box, lamp, and printing frame entirely myself. The lens cost me 7s. 6d., ground glass 6d., and screws for tripod 1s.; thus my apparatus did not cost me more than 10s. altogether. Chemicals cost me 4s., plate (one dozen) 1s., packet of C.D.V. papers (42) 1s., bringing the first outlay up to 16s.; and when I succeeded, by following the directions in the articles on 'Dry Plate Photography,' in Vols. V. and VI. in turning out something worth the trouble, I further invested 1s. in 100 plain Bristol mounts. I may say that I had not got through more than half my first dozen plates before I had some presentable *landscape* photos fit to mount. For my part, I do not believe that photography as a hobby entails more expense than any other. Take, for instance turning: you cannot turn without a lathe and some tools, and your wood, polish, glasspaper, glue, etc., will be a continual expense; so with joinery, carpentry, and fretwork. Piano and organ building are notoriously expensive hobbies; so, also, is metal turning. Electricity, except in a very small way, will run into a good deal of cash.

"In the article referred to, 'A Printer' says that an amateur photographer 'must have no other hobby.' This is where, I believe, he is wrong, for if the said amateur can turn his hand to other hobbies, he is able to construct apparatus for himself, and is not obliged to pay the high prices asked for some of the handy appliances now in use.

"There is one point I should like to mention before closing, and that is, I do not believe there is one amateur photographer in five hundred who sensitizes his own paper, and yet the greater part of this article is devoted to instructions for doing it. When, in my rambles, I meet the five-hundred-and-first man, I shall certainly make a note of having found him."

[There is one great advantage in sensitizing one's own paper—the amount of silver in the paper can be regulated to suit the negative. By this means the very best result is secured, and the extra trouble involved is really very little.—Ed.]

SEMPER FIDELIS writes:—"As I am interested in photography, I accept the

Editor's invitation to come forward on the subject. I am doing dry plate pictures; since the revival of photography, which took place on their introduction in 1878 and 1879, I began in a small way, particularly so as goods were then very expensive, and were uncertain compared with their present market values and prices; but I may say at once that if you intend to be a really good hand, you will require to keep up your practice, and to do this you must use plates, etc. I should be very sorry to think, however, that you should give up all other hobbies for it. This, simply, is not a fact. I have several hobbies. I am a carpenter, a draughtsman, and a good many things beside what I get my living at, and neither of these interfere with my pictures. You must not, however, conclude that owing to its simplicity (for it is simple) that it is to be indulged in for twopences and sixpences. At least, I have not found it so in anything like decent work, and I am not a bad judge now. Of course, a man may buy a machine for £2, buy a box of quarter-plates for 1s. 4d., and develop the whole lot for a total cost of 2s. This does not seem much; but then he soon tires of quarter-plates (I nearly always use whole plates), and he soon tires of common cameras and lenses; and this is where the expense comes in; at least so I find it. As to 'A Printer' making heaps of failures, I fear that was his fault entirely. I find the process so simple, and so have the many friends that I have taught, that they have learnt almost the whole art in a few weeks. I am one who goes in for economy. I finding, as I said before, that apparatus is expensive, made my own camera, which cost me, complete, 15s.; but, unfortunately for beginners, it is not everyone can do so. The lens cost 15s.; this is a whole plate machine, and whole plates finished, printed, and mounted, cost more than the twopence and the penny that 'Co. Cavan' would have us believe. I am glad he wrote, however, as he opens up a question that has many answers, and which is so very engrossing a subject. Of course, I have no patience with persons who find pleasure in swallowing brandy at sixpence per swallow, and I hope none of our readers have; still many a good man

gets a brandy-and-soda down now and again. Hoping to see a good many opinions expressed."

[Let me see the designs you mention.—Ed.]

#### Speed Gearing for Lathe.

C. J. WOLFE writes in reply to E. J. Smith (p. 432):—"Thanks for your criticism of my speed gearing. As you say, the strap is very short, the distance from centre of mandrel to that of counter-shaft being  $8\frac{1}{2}$ ". But the strap is not tight, as when arranged for high speed the large pulley on counter-shaft is 9" diam. of oak; and the small one, 3" diam. on mandrel, is covered with leather, which gives it a great hold on the belt. I do not find the lathe runs heavy, as in turning deal at such a high speed the cut is not very heavy. On the slow speed it is much better, but in place of a 1" strap I use a  $1\frac{1}{2}$ " one for the short belt, as I found the narrower one slipped. I gave it a good trial by turning up a cast-iron face-plate 8" diameter, using a worn-up triangular file for the job, the only mishap being a catch of the tool in a slot occasionally, which threw the long belt off. Calvert's 'Mechanic's Almanack' advises the use of leather to lag the pulleys with, as giving 50 per cent. more grip, and the trial I have given it confirms that statement. The lagging should have the hair or smooth side next the hair side of the belt; then if the belt is soft and pliant a perfect grip is obtained, a sort of vacuum being formed between the two surfaces. The belt, too, may be fairly slack for ordinary wood work, thus lessening friction and the wear on bearings."

[For a method of lagging cast iron pulleys with leather, see Vol. I., New Series, page 272.—Ed.]

#### Marble Top and Tiles for Washstand.

R. R. (Portlawn, Ireland).—It appears to me that I can help you but little in the direction in which you at present request enlightenment. I gather from your letter that you are not in the trade, therefore I must tell you that it would be entirely useless for me to supply addresses of marble masons and tile manufacturers; for although I could name several in both branches of industry, it is generally a rule with the majority of firms to desire the accompaniment of a trade card with orders



from new customers. There are a few shops scattered about in this wicked town of London, in which I reside, wherein they retail marble tops and tiles; but I do not think it would be of much utility to speak of them further, either for you or others, for in your case the cost of carriage would be sufficient reason to preclude all possibility of your ordering therefrom. Of course, I am aware that you ask for *imitation* marble tops. The only imitation I am acquainted with in this way is the material similar to oilcloth veined to represent marble; but if you desire to make use of this class of stuff, I should advise you, in all sincerity, to use in preference American cloth, which, as perhaps you know, is glossy, washable, and durable. The imitation marbling is usually but a poor substitute for the original. The American cloth is obtainable at nearly every draper's in England—I cannot answer for Ireland. Obtain the loan of a few directories of your localities, and search diligently therein for addresses of the makers of the required articles.—J. S.

#### Index for the First Series.

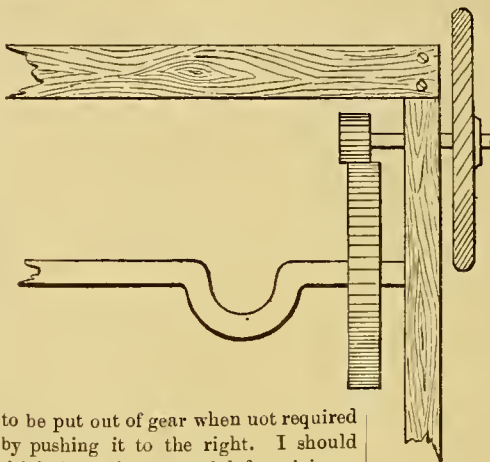
EXCELSIOR, S. A., writes—"I should be very glad if the publishers would issue a full and comprehensive index in one book for the first seven volumes. I should like to see an index compiled upon the same lines as the index of the *English Mechanic*. The synoptical index issued with each volume makes it very difficult to find much valuable information contained in the various articles. For instance, in the articles on 'Patteru Making' there are contained many valuable hints, wrinkles, and methods applicable to other work than pattern making, yet they do not appear in a ready form of identity. But in an analytical index each would be found in its alphabetical position. I feel sure others have noticed this difficulty; and if the publishers will consider the matter, and let us know the cost, I am confident it can be done. I would suggest that the requisite number should pay one guinea or two guineas each for the first twenty proofs, so that the majority could get the book at about five shillings. I shall be willing to subscribe."

[The production of such an index would be a task of considerable magni-

tude, and I very much doubt if there would be sufficient demand for the work to cover the cost of preparation and publication; but if other readers are of the same opinion as "Excelsior," I shall be glad to hear from them.—Ed.]

#### Fly-wheels.

C. J. WOLFE writes:—"I should like to ask Mr. E. J. Smith if he considers an extra fly-wheel at left of lathe (as per sketch), on principle of Britannia Company's saw, would be useful; the wheel



to be put out of gear when not required by pushing it to the right. I should think it might be useful for giving a steady speed to the crank shaft when required to revolve slowly. The wheel to be about 30 lbs."

#### Britannia Co.'s New No. 10 Lathe.

E. C. K. (*India*)—I reply to your questions in the order in which you ask them. (1.) I have tried the lathe, and have no hesitation in saying that for the price there is nothing better in the market. (2.) The lathe is light running and easy. (3.) The driving wheel has a heavy rim, and appears satisfactory in all respects. (4.) Weight of wheel about 52 pounds. Diameter of highest speed 21 inches. (5.) Lathe is firm and well-proportioned. (6.) You must use your own judgment, but if you require a cheap lathe for wood turning you will get nothing better at the price. (7.) Speeds of fly-wheel are turned. (8.) Weight 144 pounds.

#### Canvas Canoe.

POGL.—You will find the instructions you ask for in the May part (page 278), a folding sheet of working drawings being also devoted to the assistance of the canoe builder. You will also see (on

page 281) that Captain Weale has kindly offered to assist intending builders; so that if you intend making use of certain materials that you mention, and will ask for the special information that you may require, I have no doubt the Captain will be able and willing to assist you through the pages of "Amateurs in Council."

#### Calico Diagrams.

E. P. C. (*Muswell Hill, N.*).—There are several methods by which you may

overcome your difficulty. In the first place, you might execute the drawings upon paper (paper-hangers' covering paper is cheap, and can be bought in rolls), and then mount the paper upon calico; or you might use tracing linen, and do the drawings with water colours mixed with a little ox-gall. If you must use calico and writing inks, first

stretch the calico, and give it a coat of clear gelatine size; when dry proceed with the drawing, mixing a little gum with the ink. If you find that the ink still runs, try mixing a little bichromate of potash with the gelatine size before applying it. This mixture when dry and after exposure to light becomes insoluble. I should like to know how you succeed.

#### American Organ Agency.

H. WEBSTER (*Tottenham*).—The address of the American Organ Agency, mentioned in the papers on American Organ Building, is 2, Osney Crescent, London, N.W.

#### Use for Cardboard.

SEMPER FIDELIS writes in reply to A. E. R.—"Get it faced with a decent surface, if not so already, and then get it cut up into photographer's mounts, all sizes, particularly those over about ten or twelve inches long, also 'cut-out' mounts for chromos, etc."

#### LETTERS RECEIVED UP TO AUG. 12.

F. A. H.; H. M. B.; G. E.; E.





# Some Types of the KITCHEN DRESSER.

By Alexander Martin



FIG. 2.



FIG. 4.



FIG. 5.



FIG. 1.



FIG. 3.



FIG. 6.







# HOW TO MAKE A BABY'S CHAIR FOR SIXPENCE.

By A LIGHTKEEPER.

**T**HE baby's chair which I am about to describe can be made out of common deal, or of more expensive wood, such as mahogany, walnut, etc. But I have made

is very cross-grained and brittle, so that great care is required in breaking up the chest to avoid splitting the broadest pieces. I have used these tea-chests for a good many purposes, and I find that the best and safest way to break them up is to take out all the nails which come in the way of the saw. Then take an ordinary hand saw and cut the chest right round, as near the corners as possible. The exact lengths required

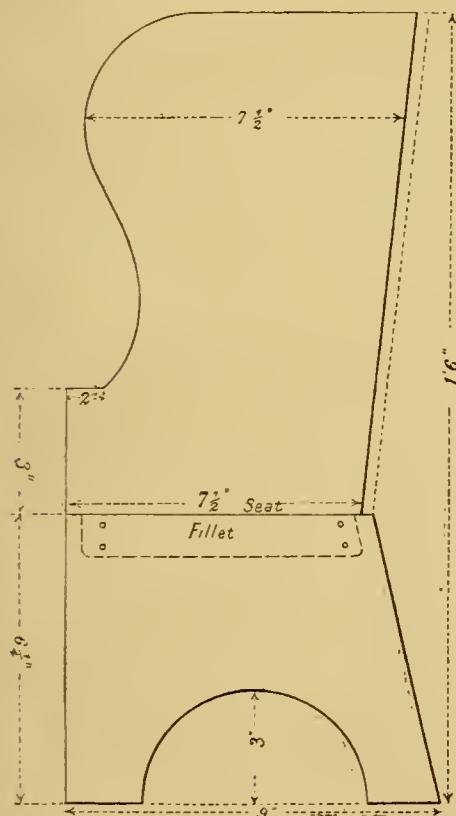


FIG. 1.—SIDE VIEW OF CHAIR.

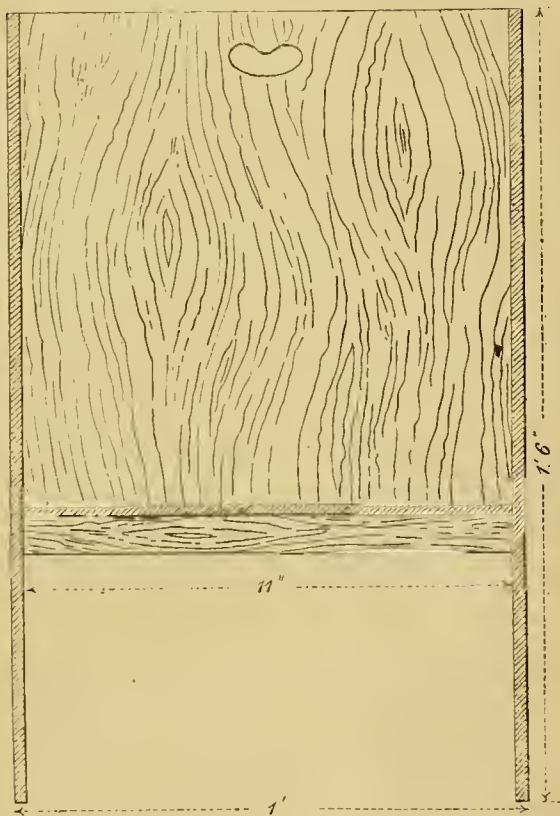


FIG. 2.—FRONT SECTIONAL VIEW OF CHAIR.

three chairs during the last ten years, and each of these chairs was made from an old tea-chest, which cost me sixpence. No doubt a few brads and screws are required in making this chair; but as I got more than a hundred useful wire nails out of the old tea-chest, besides a lot of firewood, I consider that the whole cost of material was not more than sixpence.

These tea-chests are generally made of a very hard wood, something like teak, and some of it

can be cut afterwards with a finer saw, before planing and dressing up. So much has already been said in *AMATEUR WORK* upon the subject, that it is almost needless to say that all the wood for the chair should be carefully dressed up, and all the front edges nicely rounded and smoothed with sandpaper. The whole of the wood in the chair is  $\frac{1}{2}$  inch thick, which is amply sufficient. The sizes required for the sides of the chair are two pieces each 1 foot 6 inches long, 9 inches

wide, and  $\frac{1}{2}$  inch thick. The shape of the sides and the various measurements will be seen at a glance by looking at Fig. 1. The width of the chair inside is 11 inches, and I made it square, simply because I think it holds the child better than when it is made a little wider at the front than at the back. The depth of the bottom, or seat of the chair, is  $7\frac{1}{2}$  inches, and I put two fillets (shown by dotted lines, Fig. 1), 2 inches broad by  $\frac{1}{2}$  inch thick, and chamfered on the lower edge and both ends, one on each side, inside, below the seat of the chair. These pieces strengthen the sides very much, and are a good support to the seat, which is nailed to these fillets with a few brads from above, inside, thus avoiding nailing from the outside through the sides. I also took a check out of the sides for the back of the chair, which extends down to the lower edge of the seat, and the back is also nailed to the seat, which keeps the chair from warping or twisting. Fig. 2 is a sectional view of front of chair, and of a piece, put in below the seat in front, with a dovetail into the sides, which strengthens the chair, and keeps it from spreading; a few brads are also driven into this piece, from above, through the front edge of the seat.

I hope, from the description and sketches given, that any amateur will be able to make one of these chairs, which will be found to be both strong and light, and easily lifted or handled by a child. I have had one in daily use for more than ten years, and it is quite good yet, although it has seen a good deal of rough handling; for the children use it as a wheelbarrow, handbarrow, and sometimes as a sledge to pull one another over the floor.

As I do not approve of fixed toy-boards, I did not make any; but those who wish to make one, can easily do so by screwing on a small arm to each side of the chair, with a hole in the end, into which a toy-board could be made to ship and unship at pleasure. I have found, from long experience, that a very good substitute for toy-board is to set the child in front of a low, hollow-seated armchair.

I may add that I have never seen a baby's chair exactly of this design, except those which I have made myself. I generally give them a coat

or two of light brown paint, but I made one for a friend lately, who got it painted imitation mahogany, and it really looks very well.

I hope I have made my meaning intelligible, but shall be glad to give any further details through "Amateurs in Council."

## A CLOCK CASE AND KEY LOCKER.

By "MALLEATOR."



SOME of the small American clocks, which are being sold by thousands in the present day in this country, are very good indeed, and are worthy of being mounted in a case of some sort or other; the only drawback, even to the best of them, being that they are rather plain to look at. Their nickel-plated cases, while efficient for the main object of covering the works, are, to say the least, unattractive.

The object of this paper is to suggest to the numerous amateur workers who are readers of this magazine, that a very easily made, but artistic, case is well within the capabilities of almost anyone who possesses a few ordinary tools and a fair amount of mechanical skill; and further, that two very useful birds may be "killed with the one stone," by combining a key locker and clock case.

This combination (which might be called "the House of Keys," and I beg to point this out as a recommendation to our Manx readers) is represented in front and side elevations at Fig. 1. It is simplicity itself as far as construction is concerned, and, I think, it also possesses the advantage of being novel.

Sometimes the keeper of the household keys, not wishing to leave store-rooms, wine locker, etc., etc., at the mercy of every inmate of the house, causes irritation to those who possess legitimate right of *entrée* to these receptacles, by going out with the keys in her, or his, pocket; whilst if Fig. 1 adorned the mantelpiece of some sitting-room, or stood upon a neat bracket in the hall, such unpleasantness need never arise.

Irish bog-oak would be the best wood to employ for this work, if such a thing could be obtained; but it cannot, and the material of which "bog-oak" ornaments, etc., are generally



composed, viz., ebony, is both too expensive and too difficult to work, for our purpose; therefore, as the locker is to be ebonized, or "bog-oakized," I think beech will suit best, as it is a most delightful wood to work, is most suitable for the simple carving which we shall require, whilst its surface is admirably adapted for staining.

The front, back, and sides are of  $\frac{3}{4}$ -inch stuff, which should be quite dry and free from flaws or shakes.

Fig. 2 shows shape and dimensions of the front. The reader may, of course, prefer either a larger or smaller locker, in which case he will enlarge or curtail the dimensions given; but the due proportion of the various parts should be maintained.

Having cut out Fig. 2 with doorway and aperture for clock, next prepare another piece for the back, exactly the same in outline, but *minus* the openings, and see that they coincide, and that the edges are square and true. The inside edges of the "gables" should be rebated to a width of  $\frac{1}{2}$  inch and depth  $\frac{1}{4}$  inch, to receive the ends of the roof, so that the latter may be flush with the outside edges of the gables, and the side "walls" are to be  $\frac{1}{4}$  inch lower than the corners of the front and back, and are bevelled, as shown in section (Fig 3); this bevel to correspond with the rebate when fixing the sides in position, in order that the roof may project in form of a narrow eave (see full size front elevation of details of corners, Fig. 4). Now get out the sides (Fig 3), and using very slight wire nails and a small bradawl, tack the front, back, and sides together.

The worker may adopt any method of jointing the corners of the work he prefers, but in this locker a very simple joint will answer quite as well as the most elaborate dove-tailing, etc.; for if the wood be well seasoned and thoroughly dry, and the edges and surface accurately planed and squared, the ground piece or base (Fig. 8), with roof, etc., will render the whole perfectly rigid and strong.

Having tacked the pieces together as directed, the next step is to draw with a lead pencil the stone work on front and sides. This should be carefully and accurately done, and offers a good

opportunity for the display of whatever artistic skill the worker may possess; but if the drawing (Fig. 1) be copied, I think the result will be found to be fairly satisfactory.

It should be borne in mind that our object is to represent old stonework; in fact, I have tried to represent portion of a restored ruin, an old church porch, in the original clock case, of which this article is a description. This being the case, the masonry should be outlined accordingly, avoiding too great regularity in the stones of the arch, corners, etc. Having drawn the design in pencil, it may be advisable to go over it with a pen and ink to ensure greater sharpness, and also to guard against any uncertainty caused by the smudging of the pencil marks. Now take the pieces asunder, and we proceed to the most important part of our work, viz., the carving of the design.

To those who are proficient at wood-carving this will be "child's play," as far as the actual work is concerned; but as this is a design differing greatly from the ordinary subjects executed, it calls for some special remarks.

The whole of the surface, then, of the "building" should be *carved*, not merely lining out the stones, etc., but modelling each stone, and taking out each clink and crevice, so that the old masonry may be faithfully represented.

The parting tool and Swiss knife are my favourite instruments for this work; in fact, no other carving tools are necessary; but with regard to this every workman has his own pet tools.

The front and side walls being carved—it is unnecessary to carve the back—the whole may now be put together finally. A thin coat of good glue should intervene between the joints, and the interstices of the corner stones should be utilised for inserting the necessary nails. The holes should be bored with a *square* tapered bradawl, and if oval section wire nails with anchor heads can be obtained, they will be found much the best for our purpose. The heads of the nails should be sent well home with a narrow-pointed punch; and if the suggestion as to inserting the nails between the joints of corner "stones" be followed, there will be little need to have recourse to putty to hide the heads.

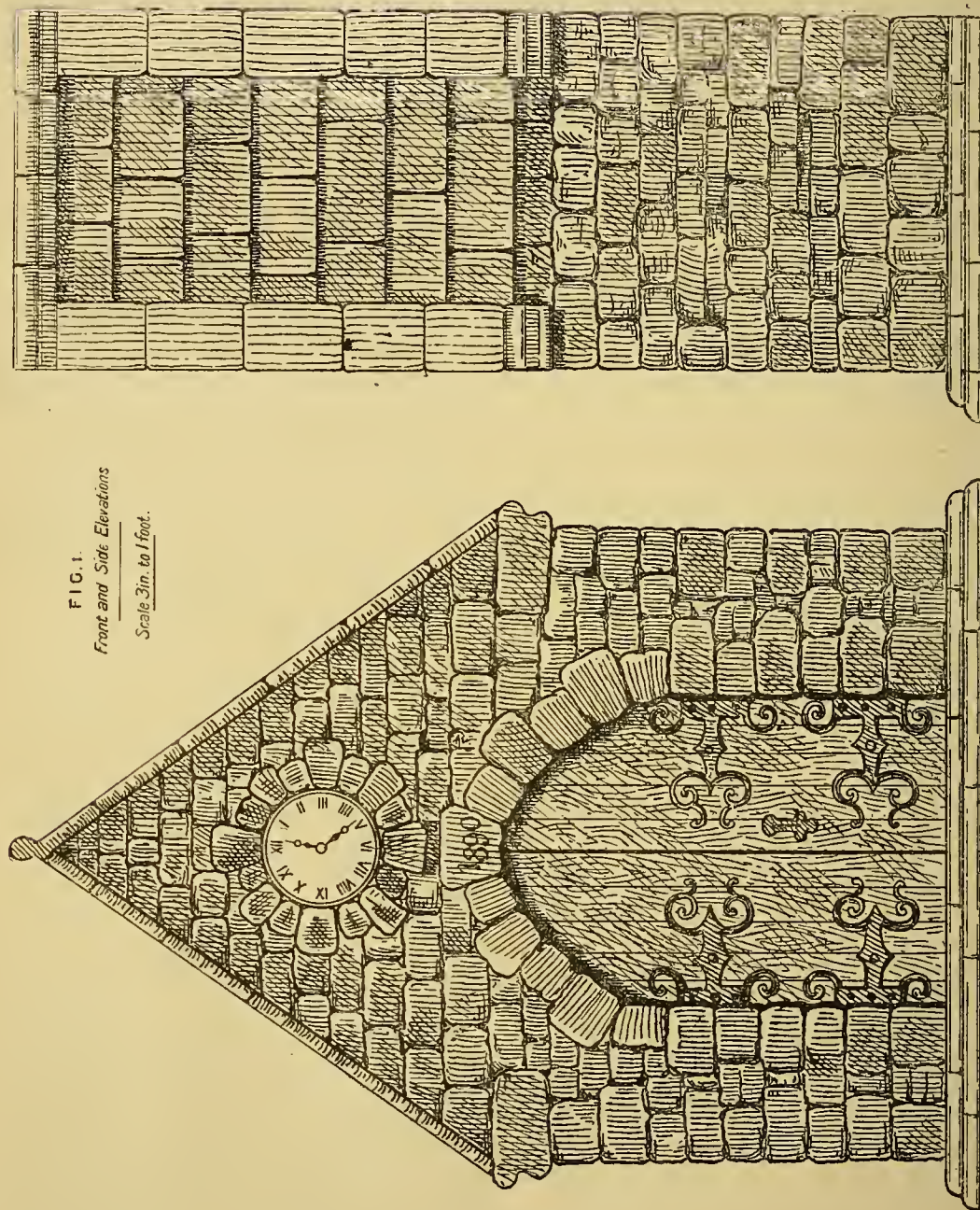
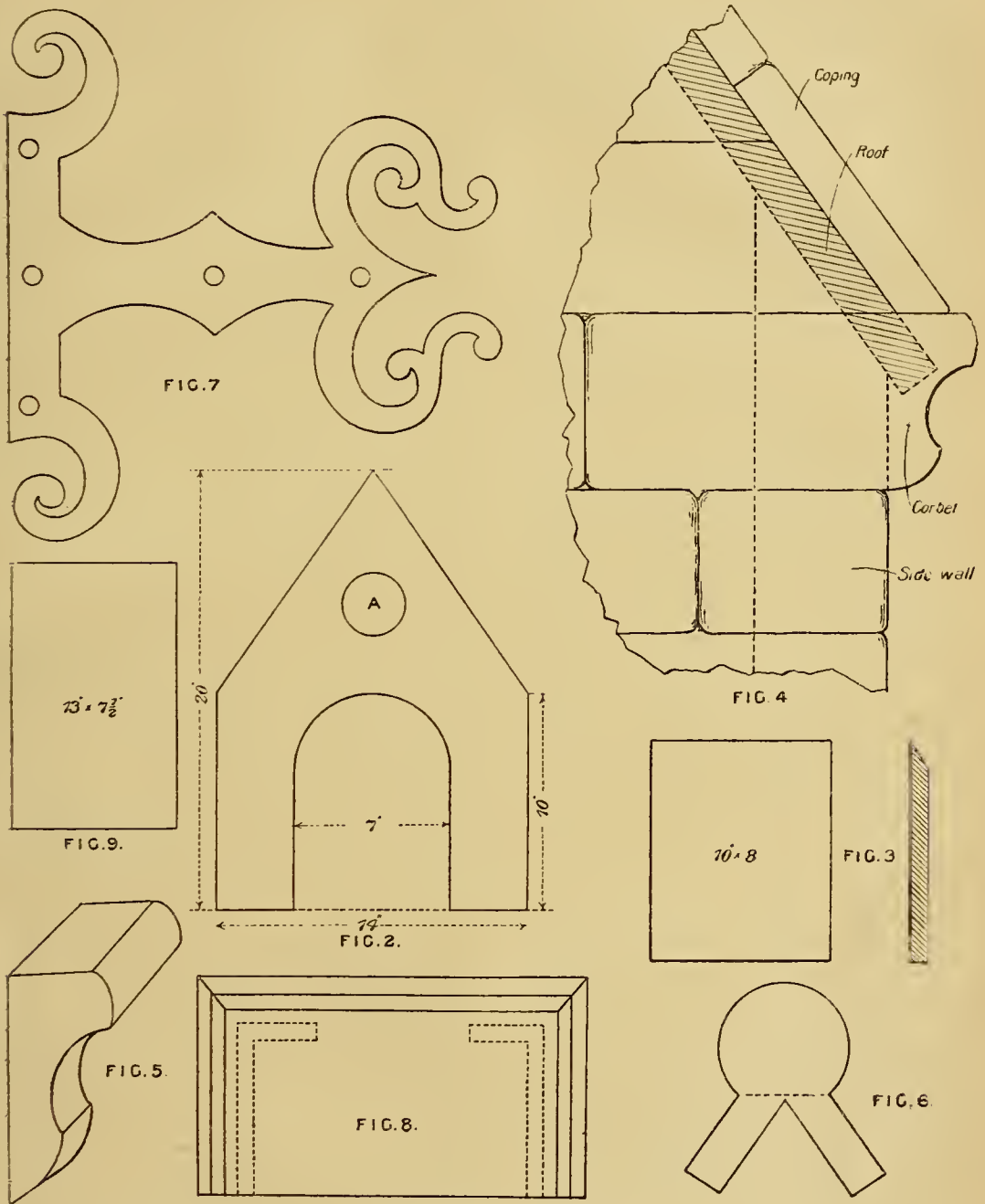


FIG. 1.  
Front and Side Elevations  
Scale 3in. to 1 foot.



DESCRIPTION OF FIGURES.

FIG. 2.—SHAPE AND DIMENSIONS OF FRONT OF LOCKER.

FIG. 3.—SHAPE AND DIMENSIONS OF SIDES (2).

FIG. 4.—DETAILS OF CORNERS (FULL SIZE).

FIG. 5.—PERSPECTIVE SKETCH OF CORBEL (4).

FIG. 6.—SECTION OF RIDGE-TILE (FULL SIZE).

FIG. 7.—DESIGN FOR HINGE-PLATE (FULL SIZE) (4).

FIG. 8.—SHAPE AND DIMENSIONS OF BASE OF LOCKER.

FIG. 9.—SHAPE AND DIMENSIONS OF SIDE OF ROOF (2).

SCALE.

FIGS. 2, 3, 4, AND 9, 1 1/2 INCHES TO 1 FOOT. FIGS. 4 TO 7, FULL SIZE.



As the work proceeds, and each portion of the locker is prepared, it should be ebonized, including the surface of all joints, before joining, because no matter how well seasoned the wood may be, there is always the danger of slight shrinkage, in which case the uncoloured wood would appear.

I find Stephens' ebony stain the best for such work as the present; and if the directions on the bottle are followed, "bar" the varnishing, a beautiful black surface will be obtained. It will, however, be necessary in this case to take special pains with the application of the stain, in order to saturate the crevices, and a good stiff brush will be found effective, both to apply the stain and to remove the superabundance from the intricacies of the carving.

The base (Fig. 8) which forms the bottom of the locker, may be of 1-inch or  $1\frac{1}{2}$ -inch stuff, and should be sufficiently large to allow a margin of about  $\frac{3}{4}$  inch all round; the edge may be either moulded as suggested by the section, or simply chamfered, according to the worker's fancy. The dotted line indicates the position of the locker upon this base, to which it may be attached by means of screws or "battens" driven from underneath. The two sides of the roof should now be cut out of  $\frac{3}{8}$ -inch or  $\frac{1}{4}$ -inch stuff, and then fitted, so as to lie in the rebates upon front and back gables; also the upper edges are to be bevelled so that they shall lie together, mitre-wise, at the top.

Now, before fastening them they are to be carved, so that the roof may present the appearance of rough slating or flagging (see side elevation, Fig. 1). With the aid of a parting tool and very sharp chisel, no difficulty will be met with in the modelling of the roof, and the worker will be well repaid if he takes pains with the modelling, endeavouring to produce not merely the effect, but the actual shape of an old flagged roof. When the two sides of the roof are carved they may be again placed in position, and temporarily secured by means of a very slight wire-nail or two.

The coping or "capping-stones," which rest on the gables and overlap the edges of the roof, are about 13 inches long and  $1\frac{1}{2}$  inch by  $\frac{1}{4}$  inch or  $\frac{3}{8}$  inch; these are also to be modelled so as to

represent a series of stones reaching from the ridge-tile, to be described presently, and resting upon the brackets, as shown in Fig. 1. A perspective sketch of one of these brackets is given at Fig. 5. These are meant to supplement the top stone at each corner, and should be cut so that they may be attached to these stones, and present the appearance of forming part of them. They may, of course, be cut out with the front and back, but it will be found more expeditious to make them separately. A small piece at the corners of the eave will have to be removed, in order to fit the brackets ("corbels" is, I believe, the correct term) in their places, where they are secured with glue, or brads, or both.

The ridge-tile extends from the outside of each gable, and should be in shape something like Fig. 6, which is a full-size section, and may be made up of three pieces (see dotted lines), or cut out of the solid.

It goes without saying that the opening (A, Fig. 2) must be cut to suit our clock—*i.e.*, just sufficiently large to allow of a strip of leather being fastened in all round, so that it may hold the clock moderately tightly; a small bracket should also be placed inside the locker, on which the back part of the clock may rest.

The swivel ring at the top of the clock may either be removed altogether, in case it prevents the clock going into the opening, or some of the wood may be removed to make room for it; and the same remark holds good with regard to the small metal legs with which these clocks are usually provided.

The doors may be of the same stuff as the rest of the "edifice," and be also ebonized, or they might be of oak, unstained and polished; but the former, I think, will be most effective. They are, of course, of the size and shape to fit the arch, and are to be hung on small butt-hinges, about  $\frac{1}{2}$  an inch from the outer corners of the doorway.

The ornamental hinge-plates (Fig. 7) may be easily cut out in thin sheet-brass or iron; the latter in case unblackened oak be employed for the doors, but the brass will look best in contrast with the ebonized wood. The doors should be fastened in the usual way, with a small bolt on one leaf, and a good lock on the other; the

keyhole being provided with a suitable escutcheon. The method of fixing these minor matters will, however, suggest itself to the worker.

When the locker is completed it should have a good coat of ebony stain, well brushed in, and when dry may be brushed over with linseed oil.

If in this paper I have entered into details which, to many of my readers, may seem unnecessary, I would point out that the details are not for them, but for those who are not practiced at work of this kind; on the other hand, to the skilled workman, I beg to offer the *idea* of a locker in this style, as one which is worthy of better treatment than it has received at my hands.

## A HANDY SUBSTITUTE FOR THE LATHE PLANER.

By F. E. TREBLA.



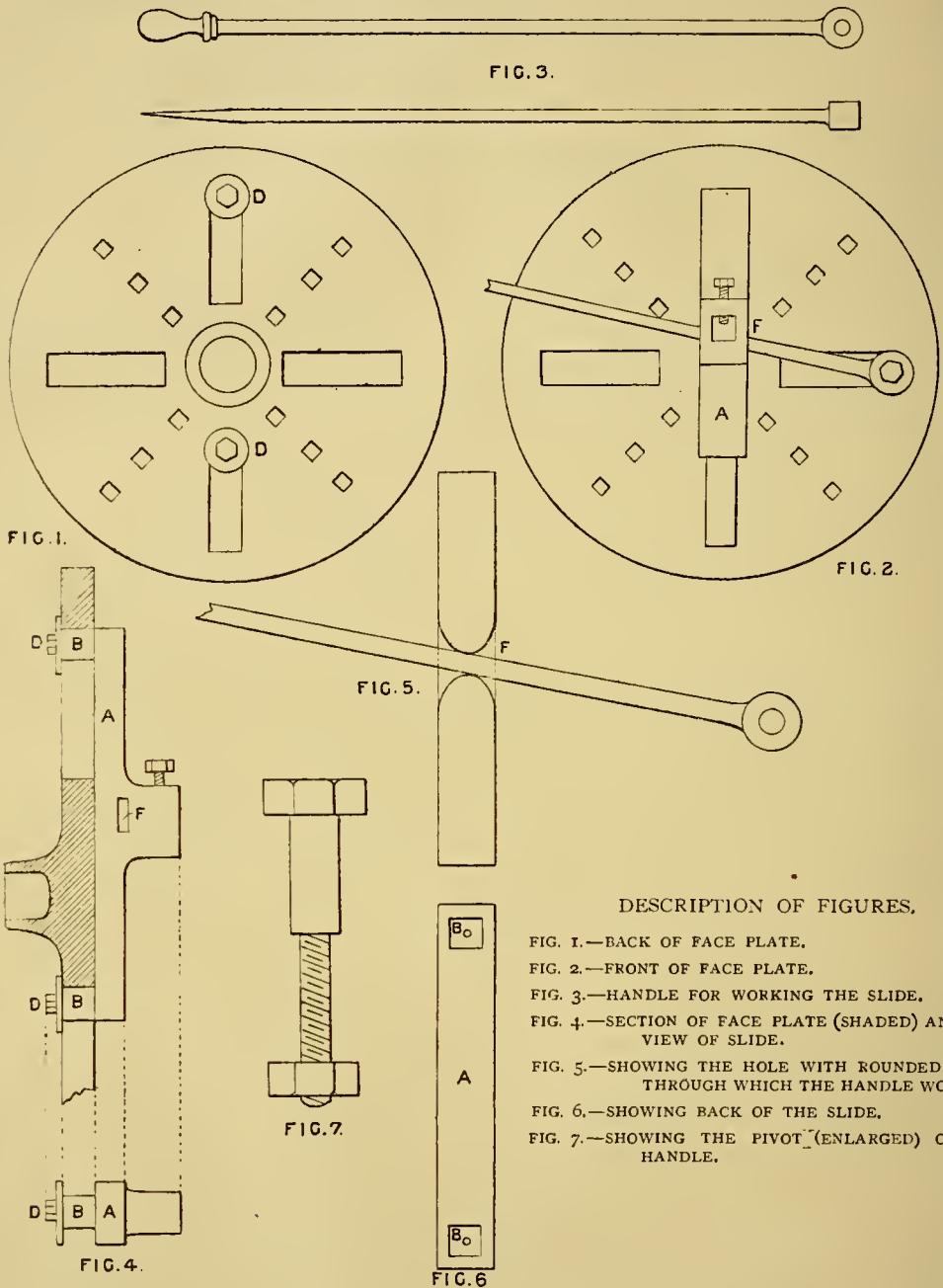
IT has often occurred to me, and especially during the "battle of the planers," which was fought in Vol. VI., that a handy little planer might be devised much simpler and less cumbersome than those generally in use. Most amateurs who, like myself, employ their leisure hours by working in their carpenter's shop, and who want a little planing done occasionally, in order to complete a model or some such piece of work, look upon a separate planer as a "bother," since it is only required for work now and then. Nine-tenths of the metal work done by amateurs can be done on the lathe without a planer; but now and then a bit of work has to be done for which a planer is a *sine qua non*, and in cases such as these a separate planer is a kind of mountain in labour, to say nothing of the expense of buying a new machine. Of course there are several good planers in the market which do their work well—Lukin's, for instance, or, better still, Balck's, or, best of all, a separate machine altogether—since work already on the lathe need not be disturbed when a separate planing machine is used. But to the majority of amateurs who want a little planing done at odd times, such as the

parallel guides of a piston rod, or brasswork for optical apparatus, where the work is not very heavy, the contrivance I am about to describe will be found exceedingly useful, and can be made with the aid of a file alone, not requiring the use of an existing planer to plane the sides, as most do.

Figs. 1 and 2 show the back and front of the apparatus, from which it will be seen that the cutter slides up and down in the slots of a face-plate when it is fixed on the lathe. The face-plate of a 4-inch lathe, for instance, will be 8 inches diameter; while, if the lathe has a gap bed, it will be, say, 15 inches, and the opposite slots, if planed parallel, as most of them are, prove very fair guides for the sliding cutter. The only casting required is shown at A, in Fig. 4, the shaded part being the face-plate; but, as there are so many sizes of lathes, it is impossible to give any standard dimensions.

Briefly, it is a flat slide, with a recess in the centre for the cutter, which is held fast by a screw. At the back of the slide are two projections, B B, which are a shade deeper than the face-plate is thick; through the end of these projections a hole is bored and tapped to take a small bolt, and between the head of the bolt and the slide a good strong washer should be placed, of such diameter that it will overlap the slots in the face-plate. The back of the slide which moves up and down against the face-plate should be carefully filed, as should also the projections, which should nicely fit in the slots so as to leave no side shade. When the nuts at the back are screwed tight down on the washer, there should be just enough play to allow the whole slide to move easily up and down in the slots, but without any wobble or looseness. Through the centre, and just behind the tool-holder, is a transverse hole, through which the handle works; the corners of this hole must be rounded off, as shown in Fig. 5, to allow the handle to work up and down. The handle is shown enlarged in Fig. 3, and should be the same thickness all its length. The wooden knob at the end is loose, so that a tap of the hammer will knock it off.

To fit up the contrivance, first screw the face-plate on to the mandrel of the lathe, then fix



## DESCRIPTION OF FIGURES.

- FIG. 1.—BACK OF FACE PLATE.  
 FIG. 2.—FRONT OF FACE PLATE.  
 FIG. 3.—HANDLE FOR WORKING THE SLIDE.  
 FIG. 4.—SECTION OF FACE PLATE (SHADED) AND SIDE VIEW OF SLIDE.  
 FIG. 5.—SHOWING THE HOLE WITH ROUNDED EDGES THROUGH WHICH THE HANDLE WORKS.  
 FIG. 6.—SHOWING BACK OF THE SLIDE.  
 FIG. 7.—SHOWING THE PIVOT (ENLARGED) OF THE HANDLE.

the mandrel tight so that it will not turn in the slightest degree. Next place the slide against the face-plate, with the projections in the slots, and screw the washers on at the back. When this is done, knock the wooden knob off the end

of the handle with a gentle blow of the hammer, and push the handle through the hole, F; replace the knob, and screw the bolt on which the handle works tight up to the face-plate, and it is ready for work. The whole apparatus can be



fitted up in less time than it takes to describe it, and when carefully put together it will answer its purpose admirably. The thick part of the bolt in Fig. 7 should be turned a trifle longer than the hole in the end of the handle, so that when the bolt is screwed up tightly on the face-plate the handle may be free to move. In addition to its being a vertical planer, it can also be changed into a horizontal one by turning the mandrel round one-fourth of a revolution, until the bolt on which the handle works is at the bottom; the slide will then work in a horizontal direction. In this way the slide may be made to plane diagonally, or at any angle to the horizontal; and I do not know of any other planer in the market of which the same can be said. The casting should be made about  $\frac{1}{2}$  or  $\frac{3}{4}$  of an inch wider than the slots in which it works, so as to give a good bearing surface. The projections at the back, B B, are square; and the size of them is determined by the width of the slots of the face-plate. The washers at the back should be as large as possible, so long as they allow the slide to be worked right to the end of the slots. If the planer be made as I have described, and the parts filed *flat*, metal workers will find it a handy little addition to the lathe, and a help towards gaining such distinction in their craft as was attained by Dick Whittington, who was undoubtedly a turner, for does not the old rhyme say, "*Turn again, Whittington!*"

GELATINE PLATES DEVELOPED IN WATER.—Dr. Buckelandt gives the following formula for backing gelatine-bromide or gelatine-chloride plates, so that after exposure they can be developed in water. The back of the plate is coated with a mixture composed of—

|                 |    |    |    |             |
|-----------------|----|----|----|-------------|
| Water           | .. | .. | .. | 20 c.c.     |
| Salicylic acid  | .. | .. | .. | 1 gramme.   |
| Gum or Dextrine | .. | .. | .. | 10 grammes. |
| Alcohol         | .. | .. | .. | 5 c.c.      |
| Pyro            | .. | .. | .. | 1 gramme.   |

The plate is then allowed to dry at ordinary temperature. To develop, steep it in water to which a few drops of ammonia have been added.

## SOME TYPES OF THE KITCHEN DRESSER.

By ALEXANDER MARTIN.

(For Illustrations see Folding Sheet presented with this Part.)

**T**HAT exceedingly common article, the kitchen dresser, is to be found in an immense variety of styles and arrangements. Perhaps the very fact that such a piece of furniture is so common, accounts for the great variety; because the numbers that are made necessitate a great many different minds being concentrated on the same article with the natural result that this, that, and the other thing may be altered or improved, either in appearance or in convenience or utility. When once some particular arrangement occurs to someone in this way, he may at once put it into execution, but only a very few people will probably be aware of it; and as this is occurring all over the country, the best way to spread abroad the different types of this sort is to illustrate them in these pages, so that readers in all parts may know something of the ways of things which perhaps seldom are seen except in one particular locality. A few forms which have come under the writer's own observation are given in this article.

The simplest form of dresser, or, at any rate, the simplest in common use, is that shown in Fig. 1. This is often put up in a kitchen by the landlord, and is usually of a coarse make. The accommodation is, however, ample, consisting of two drawers, and a cupboard enclosed with two doors. The sizes are: Length, 4 feet; width, from 18 to 24 inches, according to circumstances; and height, 3 feet 3 inches. The ledge round the back and ends of the top is as often as not, omitted; but it is better to have it, as it prevents articles from slipping over. Inside there is a sparred shelf about 2 inches from the floor, for accommodating pots and pans, etc., and another shelf is often put in rather more than half-way up, and only two-thirds of the full width of the dresser. Observe that the doors come within half an inch of the floor, and that the panels are filled with matchboarding, which material is also used in finishing the

gables. These gables are framed up with  $2\frac{1}{2}$  by  $1\frac{1}{4}$  stuff, the top rail being deep enough to receive the drawer bearers; the matchboarding is nailed outside this frame, and so forms the gable. The drawers are 5 inches deep, and have wood knobs on them, as has also the door, with the addition of a turn-button. The back is also made up of matchboarding, fastened to the top and bottom rails connecting the gables together. When the dresser is intended to be fastened to the wall, this back is sometimes omitted altogether; but it is much better that it should be put in. This, then, is about the commonest style of dresser in use. The next illustration (Fig. 2) shows an improvement in the make of the article. Nothing very much is done in this; but what a vast improvement it is on the former sketch! A base is mitred round front and ends, the doors are framed with a planted moulding round the panels, and the back has a narrow shelf in it. The gables also are shown of solid wood, inch thick. The shelves inside are also somewhat different; the bottom one is solid—not sparred—and on a level with the top edge of the base, and the upper one about half the full width of the dresser.

Another step in advance is gained in Fig. 3. The cupboard, while stretching from gable to gable, as before, is, in this instance, enclosed by two doors with a fixed piece between them, panelled to match. Underneath the top there are three drawers, the centre one being shorter than the others, and furnished with a lock. It is used by many people as a money-drawer—hence the lock. The back has, in addition to the shelf, a row of small drawers, for holding spices, etc.; accommodation which most housewives will heartily appreciate. The easiest way to make these little drawers is to take two shelves the full length and width of the top one, and raggle the divisions into them; the divisions should be nearly the full width of the shelves also, and in this way no drawer guides are necessary, as the drawer slips into its space without any other preparation. This dresser is a very usual one to be found in houses; it seems to be a favourite.

That shown in the next illustration (Fig. 4) has two features differing from those already shown.

First, the drawers under the top are extra deep, the drawer front being eight inches wide. This enables a knife-tray to be let bodily into the drawer, and as it rests on fillets screwed to the drawer sides, the space underneath the tray may be fully utilised; the other drawer may also have a tray in it, half the width of the drawer, so that it may slide backward and forward as required. The cupboard below being curtailed in height, because of the extra depth of drawer, the centre shelf is placed about two-thirds up, and is only one-third the full width. The second new feature consists of the addition of a narrow shelf just underneath the row of spice drawers; this will accommodate cups and many other little things always necessary in the kitchen.

A much more unusual form of dresser is shown in Fig. 5, where cupboards and drawers seem mixed up together; all the same, it makes a neat little dresser, commodious and useful, and quite ornamental, too. The diagonal V-jointed boarding so commonly seen in bedroom furniture some years ago, is very decorative here, and the perforated ledge in the back also ornaments the whole. The great objection to this design is that, in a 4 feet dresser, the cupboards will naturally be very narrow, and on this account it would be better to make it 4 feet 6 inches or even 5 feet long. An inside turnbuckle, or a lock, must be used for these doors, as it is quite evident that an outside button would, when fastening the door, also prevent the drawer alongside from being pulled out. The button might be put on opposite a fore-edge, but even then it would be apt to lock the drawer above or below, unless it were put perfectly straight across, a thing very seldom performed in actual life.

In our next illustration a much taller back is given than in any of the preceding ones. The under portion is similar to some of the others, but the back has a double plate-rack above the row of small drawers. In setting out this plate-rack, the first bar, 1 inch wide and  $\frac{5}{8}$  inch thick, is placed  $5\frac{1}{2}$  inches above the shelf. About  $3\frac{1}{2}$  inches above this stands the next shelf, a narrow one, only about 2 inches wide; while the bar above that stands  $5\frac{1}{2}$  inches higher again. Both these bars stand about  $3\frac{1}{4}$  inches clear of the

back. The heights given are all to the top edges of bars and shelf; and the distances ( $5\frac{1}{2}$  and  $3\frac{1}{2}$  inches) are all taken from the top edge of one to the top edge of the next.

With the exception of the last design, these have all been with low backs; but many dressers have much higher backs than Fig. 6 has, and in addition have cupboards in the upper portions, and more ornamental features as well. Perhaps, with the Editor's kind permission, I may later on give some illustrations of these taller varieties, but in the meantime I must bid the patient reader adieu.

## THE DULCIMER.

BEING A DESCRIPTION OF AN OLD INSTRUMENT, AND INSTRUCTIONS HOW TO MAKE ONE, WITH MODIFICATIONS SUGGESTED.

*By B. A. BAXTER.*

### I.—DETAILS OF OUR MODEL.

**I**N describing this old dulcimer, I wish to explain exactly how it has been constructed, and shall point out where the amateur can lessen his work in making one.

The shape, as most readers of *AMATEUR WORK* know, is a four-sided figure, two sides being parallel, and the ends wider apart at the side nearest the performer. Fig. 1 represents the plan of the instrument one-eighth real size lineally. (To avoid confusion I have only drawn the centre wire of each group.) The length of the longest side is  $36\frac{1}{4}$  inches; the shortest side,  $19\frac{1}{2}$  inches; outside width, measured across the centre,  $16\frac{1}{2}$  inches; the angles are equal, that is, the two acute angles nearest the player, and the two obtuse angles at the farther side are also equal; the ends are of beech, and these are the most important part of the instrument; they form a wrest-pin plank and a hitch-pin plank, the tuning pins being towards the right hand of the player. In this old instrument there are 100 wires, in groups of five each. We shall use groups of three only, as we are able to get steel wire of great tenacity and strength,

instead of brass, as in the old one. These beech ends are shown in section in Fig. 2. It is important to select the right way of the grain in preparing these ends. The pins ought to cross the "silver grain," or those radiating lines which in beech, oak, and other hard woods proceed from the centre to the circumference of the tree.

These ends, then, are 18 inches long,  $2\frac{1}{2}$  inches wide, and  $2\frac{1}{4}$  inches thick. I shall suggest that the amateur make his dulcimer with beech ends a trifle wider; but I am faithfully describing this one, which is very old, so old that it was made before pins were drilled for the reception of the wire, and it would be almost impossible to string it with modern steel wire. But our ends are not yet fully described.

The external edges are reduced in ogee form for a lighter appearance, and partly, no doubt, for convenience in handling. Here we are taught that the reduction has been carried too far in our old model, for it bears marks of having failed here and there. We only need to remember the 100 holes for tuning pegs in a space of less than 18 inches long and 2 inches wide, to see that more beech or fewer holes would be more likely to endure the strain.

The bottom of the instrument is yellow pine, free from knots,  $\frac{1}{4}$  inch thick; each end, cut to the proper angle, is fitted into a groove in the beech planks, and six screws are inserted through beech and pine, holding the whole firmly together; glued blocks are fitted inside the angle to strengthen the joint.

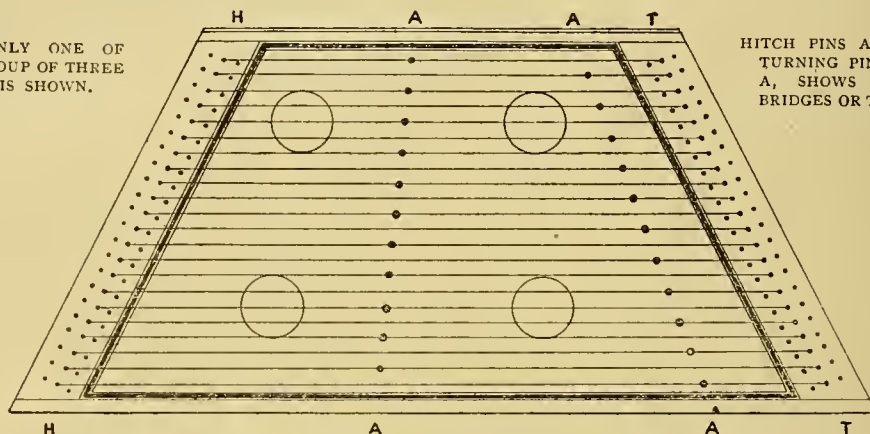
The top is also of yellow pine,  $\frac{1}{4}$  inch thick. This has four large holes, originally having turned mahogany rings fitted in, each ring held a six-rayed star, made of twelve pieces alternately black and white veneer. This would not improve the sound-board, as a sound-board; and our friends will not be urged to copy this difficult work, just so much geometrical inlaying. This upper sound-board (for both top and bottom act as sound-boards) is not flat, but is convex on top in the direction of the strings; for under the bridges, or rather the turned feet which act as bridges, in this old instrument, there are two strips of wood, pine or white



deal (it is difficult to say which, but either would do),  $1\frac{1}{2}$  inches deep,  $\frac{1}{2}$  inch thick, pierced with holes  $\frac{3}{4}$  inches diameter, about  $1\frac{1}{2}$  inches apart, as the space between the top and bottom is  $1\frac{1}{4}$  inches at the beech ends; these  $1\frac{1}{2}$ -inch strips force the top to a curved shape, as just mentioned. The top, as may be perceived from Fig. 2, is fixed to the beech in a rebate cut for that purpose, and a piece of hard wood—the harder the better—fixed on, as shown by the black space on the figure. Here again I believe we can improve by making this hard wood

evidently been fixed after the ends of beech have been cleaned off, flush to the edges of the top and bottom. The shape of the longest side is shown in Fig. 3. This is glued on to the ends, and appears as if it had been screwed, but dowels would be better. The sides are flush with beech ends, therefore a full  $\frac{1}{4}$  inch below bottom, a piece of wood about  $\frac{1}{4}$  inch by  $\frac{3}{8}$  inch being glued and bradded to sides, and glued only to bottom. The top edge of sides has been carefully planed to the figure the sound-board has been constrained to take,

NOTE. — ONLY ONE OF EACH GROUP OF THREE STRINGS IS SHOWN.



HITCH PINS ARE ON LEFT, TURNING PINS ON RIGHT. A, SHOWS POSITION OF BRIDGES OR TURNED FEET.

FIG. 1.—PLAN OF DULCIMER, ONE-EIGHTH FULL SIZE. THE SIZE AND POSITION OF HOLES IN SOUND BOARDS IS OPTIONAL, IF THEY AVOID BRIDGES OR TURNED FEET.

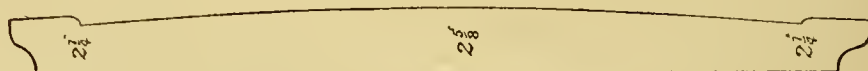


FIG. 3.—FRONT OR LONG SIDE OF DULCIMER, ONE-EIGHTH FULL SIZE.

strip thicker, cleaning off part with a rabbet plane, and covering the whole of the beech and part of the strip with sycamore  $\frac{1}{2}$  inch thick. We can then, if necessary, clean off the edge of the strip, or we can preferably cut a neat channel, and lay a piece of wire about  $\frac{1}{8}$  inch in it, as it is very important that the string should be of *definite* length.

I have here described how the evidences of construction show themselves. Anyone who had this old dulcimer to examine would see that the beech ends were prepared first, the bottom fixed next, then the two perforated strips under the spots in Fig. 1 glued on. The sides have

and a piece of stuff  $\frac{1}{4}$  inch thick, preferably hard wood, moulded on each inner edge, like the slip marked black in Fig. 2, has been fixed on edge of side, covering the joint, the moulding mitreing with that on the beech ends, and making the sides, which are  $\frac{1}{2}$  inch thick, appear to be thicker. Fig. 4 will explain. The strips of wood having the centre-bit holes in them do not appear to quite touch the sides, but it would be better to fit their ends into a groove in front and back; this would strengthen the whole, though they are primarily intended to act as sound-posts to keep the top sound-board from depression by the pressure of the

bridges, and as bars to stiffen it at the same time.

The whole of sides are in our model veneered, and the edges of sides as well; but if we do our work well and use a harder wood, we may be excused veneering.

The instrument stands on five brass feet, like caddy feet—three in front, and two at back. There is also a shaped mahogany rest hinged underneath like a reading desk, so that the performer can slope the instrument about as much as a writing desk. I do not see that this

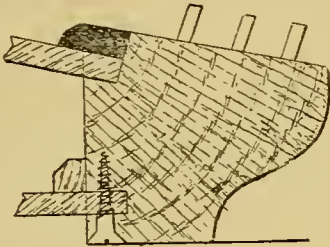


FIG. 2.—SECTION OF ENDS, HALF SIZE, SHOWING RIGHT WAY OF GRAIN.

is needful; if it is, I should prefer taller feet. I have said the stringing is brass wire, very thin, and though five to each note, could hardly have been very powerful. There is a wrapping of thread or silk to each tuning-peg in lieu of holes; and how much patience the player required to replace a string I do not know, but it must have been considerable.

Having now pretty fully analysed the old dulcimer, and having found out its mode of construction by its own testimony, there is very little left to tell intelligent amateurs beyond what I have said in passing. No doubt steel wire will improve the tone, and three wires instead of five materially reduce the labour of boring. We will, however, put twenty-two groups of three each, instead of twenty, which will, I believe, be an improvement.

In an instruction book published by Roylance, of Tottenham Court Road, London, there are sets of slips to paste upon the instrument by which it is to be tuned, and which will materially help the learner in playing it.

The strings are, in this scheme,  $\frac{5}{8}$  inch apart from centre to centre of each adjacent group. Let us decide, then, to have our sound-board

15 inches wide, 15 inches long at short side, and 30 inches at long side, that is excluding ends and sides.

Let us be careful to select the beech the most favourable way of the grain, so as to avoid splitting. We will then groove the ends for the bottom, choosing a plough-iron  $\frac{1}{4}$  inch wide, and setting it  $\frac{1}{4}$  inch from bottom edge. The rabbet in top side of ends for the sound-board is cut parallel to the top, which is sloped like Fig. 2. The moulding fixed over top, and covering joint, will convert this rabbet into a groove; the overlay on the edge of sides is moulded to the same outline, and mitred at the intersection.

It would be well to make the sides of stouter stuff than in our ancient friend, like the dotted lines in Fig. 4, making a rabbet for top and bottom, and abutments to fit the beech ends; or, if that is too troublesome, have a well-fitted block fixed to ends first, and cleaned off flush to the edges before the sides are fixed.

Small angle blocks may with advantage be placed at short distances at the junction of bottom and sides, and also in the angle of bottom and ends. These blocks must fit

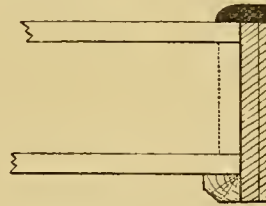


FIG. 4.—SHOWING MODE OF FIXING SIDES.

accurately, and be glued with good thin hot glue, slightly rubbed to their places.

It would be a great assistance to mark the whole thing out and fix the sizes, allowing  $\frac{5}{8}$  inch for each set of strings, and that the top and bottom strings ought not to be too close to the edges, or the tone will suffer, so that a little extra width of sound-board will be a distinct advantage.

In the next chapter I will give particulars for spacing the strings, boring bridges, scheme for tuning, etc. In the meantime I wish all who undertake the work such success as their perseverance deserves.

## MODEL BOAT BUILDING, WITH PLANKING.

### CUTTER RIG.

By *PAKEHA*.



HE preliminary to building a model boat is to decide upon the shape and size it is to be. I propose to describe the mode and materials I have myself been using lately. My first procedure was to obtain the body and sheer plans of the proposed boat; this I did on a small scale. I then enlarged them to the desired size, namely: length, from 29 to 32 inches. The size must be so arranged that the garboard strake does not exceed 2 feet 11 inches. The plans given with this are on a scale of 3 inches to the foot, which will be found most convenient for readers who are not well acquainted with the reading of plans. It is only necessary to enlarge each line four times to obtain a full-sized drawing, and this is the first thing that the builder should do.

I will suppose the plans drawn out, and load-water line marked. The first step in the building will be to obtain a rectangular piece of mahogany,  $\frac{5}{8}$  inch thick, of sufficient size to allow the sheer plan being drawn out on it, which should be done. The keel should not come within  $\frac{3}{4}$  inch of the bottom of the wood, nor the bow within 1 inch of the end. The plan being drawn as Fig. 1, a line (x) should then be drawn  $\frac{1}{2}$  inch within the keel all along and up to the deck line by the stern post. The mahogany should then be cut with a frame saw clear of the line x, taking care not to go over the line. Then the outline of the keel should be cut out so that the keel and cut-water and stern post at line 16 will come away in one piece. We then have Fig. 4 marked on it the positions of sections 1 to 15. The wood that remains (Fig. 5) must next be fixed so that the cut-water part is perpendicular to a piece of  $1\frac{1}{4}$ -inch deal. It may be screwed along its length, and the upright parts tied by a cross-piece of wood to keep it quite firm and free from shake. The keel, being smoothed, should then be rabbetted on each side up to the line

now marked on it, which shows the limit of planking, so that the cross section at 9 will appear as Fig. 6. The prepared keel may then be replaced where it was cut from, and fastened by small metal plates screwed to the keel, and to the shape fixed on the board. The keel being ready, we next go to the ribs; they are best made of  $\frac{3}{4}$ -inch oak. No. 16 should be prepared first. I made my ribs by drawing out each body section separately on paper, gumming it to the wood, and then cutting the wood to shape with a frame saw. No. 16 being cut out, the width of the stern post must be marked on it, and cut out so that the two pieces may be glued and fastened on each side of the stern post, which must now be fixed as the bow end was previously, so as to be quite without shake. I then cut out sections 1, 2, 3, 4, 6, 8, 10, 12, 14, and 15 in a similar manner, and also cut the centre away so as to have only skeleton ribs, as Fig. 7. I dovetailed each rib into its place, so that the stern side was exactly on the line marked for it on the keel. The ribs must each be bevelled according to the slope marked for it on the half-breadth plan (Fig. 3). Each rib as it is put in its place should be plumbed upright and glued, and then a knee glued to it and the keel, to help keep it in its place. Each rib had a piece screwed to it across the end, the middle of which was marked as Fig. 7. When all the ribs are in their place, a piece of oak  $\frac{1}{4}$  inch thick and  $\frac{1}{2}$  inch wide should be screwed by one end on top of the cut-water, and also screwed to each rib exactly over the centre mark, the ribs being each plumbed upright whilst fixing, and the other end screwed to the stern post, with about 6 inches projecting. The stern should now be cut out of oak similar to the ribs, and fixed to the stern post by the bottom at the angle and position shown on the sheer plan. The width of this is shown (Fig. 3, section 19); the sectional shape is shown on the body plan, and the actual shape must be calculated from that. When fixed to the stern post by glue and screw, the top of it must be screwed to the piece of wood projecting in its right place, and carefully kept in the exact middle.

We have now the keel with ribs attached;



in fact, the framework complete, fixed firmly to its cradle, and can proceed with the planking. First, to obtain the planking. I know of nothing better than the oak strips used by printers, each 3 feet long, of nonpareil thickness, which may be obtained of C. G. Squintani and Co., 96, Farringdon Street, London, E.C. When ordering specify nonpareil reglets, and get four dozen. I think they cost 9d. per dozen; or a printer would get them for you. You must now soak each plank so as to be easily moulded to the shape required. For this purpose get a piece of iron or zinc or tin guttering, about 4 feet long. Stop up each end, and fill up with sand. Put some of the planking in the sand, and pour boiling water over it, as much as the sand will soak in nicely. In about half an hour your planking will be ready to use. While it is soaking you can fasten on the garboard strake, that is, the top plank of all. I fixed mine on with small brass screws,  $\frac{1}{4}$  inch, as No. 0. The holes must all be bored for them, so get the smallest size bradawl for the purpose, or else an Archimedean drill, with 14 m.m. drill in it. If the holes are not bored, the screws will not go home in the oak, but the heads twist off. One end of the plank must be shaped to fit the rabbet cut in the cut-water, and the plank screwed up close to the rabbet; the top edge should then be screwed flush with the top of ribs 1, 2, and 3. Then prepare the plank for the other side, see that the same distance is used to come just to the edge of rib 3 on both sides, and screw it on, so that you know the two sides are exactly similar; then proceed to screw to each rib 4, 6, etc., fastening each rib before going to the next one, and measuring that the distance from the preceding rib is the same on both sides. You will find that the top plank will take any twist required without soaking. As each rib is to be attached, put a drop of glue between the rib and the plank. The plank I put on next was one which I arranged so that the top edge was exactly on the water line marked on each rib, which later formed an excellent guide for ballasting. For this purpose take out one of your soaked planks, let it steam for a minute or so, and wipe as dry as possible; cut one end to fit the rabbet as before, and,

putting a little glue in the rabbet and on each rib as required, fasten on with screws. You will find a screw on every two or three ribs will fix the plank, and you can then go carefully over it and screw up each rib, and cut off the extra plank which projects beyond the stern. Take another plank and bend it below the one already fixed; you will find it will either overlap each end, or else will not meet the other about ribs 8 and 10; let it overlap at the ends, fix with a screw on rib 8, and bend it to fit the cut-water overlapping; screw it in the middle of the plank to the cut-water, and also to the sternpost overlapping there also. With a sharp pencil mark from the inside the amount of overlap all along. Unscrew it, and pare it to the line marked; see if it now fits properly, that it is close to the water-line plank all along its length; if correct, number it and mark off a dry plank to the same shape, and put the same number on that. Now fit your steamed plank to the cut-water, glue the cut-water rabbets, each of the ribs, and the top edge of your plank, and fix in position, holding it firmly against the upper plank whilst fixing. Proceed in a similar manner with all your below water planks; when shaped, marking off a corresponding dry plank, and numbering it. When fixing the lowest two planks, you will find the advantage of having the rabbet wide; the depth of the rabbet should be just the thickness of the planks, that they may be flush with the keel when finished. Whilst fixing the two last planks, you may be soaking the prepared planks for the other side. After both sides are planked below water line, you will do well to give the inside a good coating of hot glue, to fill up any small cracks between the planks and the ribs, etc., to make it fairly water-tight. Now proceed with the planking above water line only; here you will find the overlap occurs in the middle, and the twisting of the planks for the stern end a little trouble to accomplish. Remember to glue every place where the planking touch one another, the ribs, cut-water, and stern. You may now remove the ties across the top of the ribs, and the piece of wood which held the ribs steady in their places. The planking being accomplished, and the glue dried hard, the next proceeding will be to make the deck. It looks

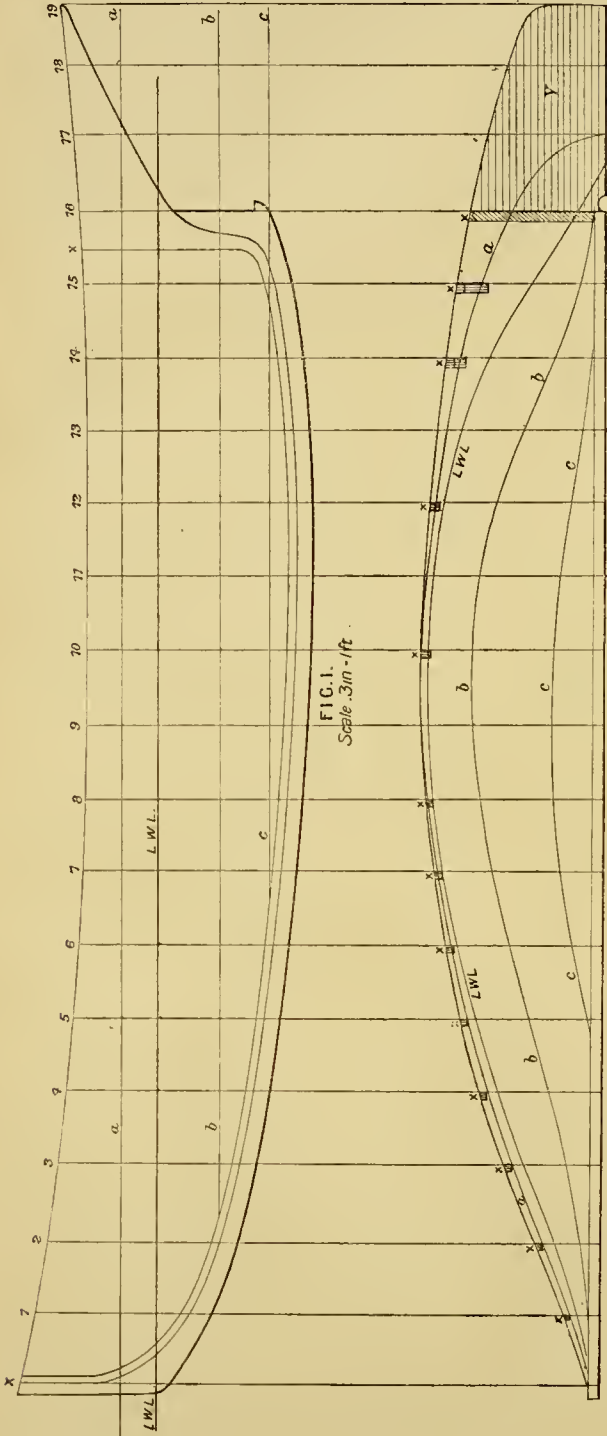


FIG. 1.  
Scale 3 in. = 1 ft.

X, X & Y are the upper extremities of the ribs  
the shapes of which are worked from fig 2.

FIG. 3.  
Scale 3 in. = 1 ft.

Y is the stern piece best made solid of  
similar oak to the planking.

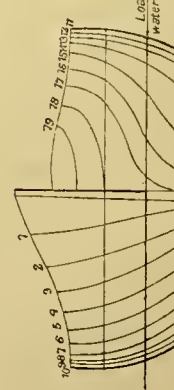


FIG. 2.  
Scale 3 in. = 1 ft.

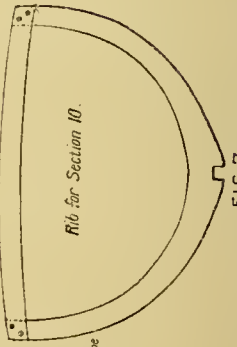


FIG. 7.  
Scale 3 in. = 1 ft.



FIG. 5.  
Scale 3 in. = 1 ft.



FIG. 6.  
Actual size

best if built of planks in a similar manner. Your boat being about  $8\frac{3}{4}$  inches beam, get a piece of wood, slightly wider and longer than the deck, planed up true on one side; mark out from the half-breadth plan the shape of the deck, then lay on it side by side planks so as to cover entirely the shape, then fix the centre one down on the board by a nail or screw every 5 or 6 inches, and glue by the edges the planks on each side, fixing each down so as to keep all in close contact whilst the glue is drying; when quite dry, the planks should lift up in one solid piece. In case of the glue running and fixing the deck to the wood, it is as well to lay a piece of thin white paper under it, as the paper is easily removed, if necessary, afterwards.

The next step is to decide the amount of bend the turtle-back deck is to have. Cut three pieces of deal to this bend, and fix them to ribs 4, 8, and 14 respectively, so that the deck may lie on them and yet touch the top plank all round; also flush with the top of the top plank glue strips of wood shaped on each side between the several ribs, so that the deck may be screwed down to these, and be in close contact with the top of the top plank; then fasten the deck with a few screws to these pieces, arranging the centre plank where the piece which held the ribs firm was taken from, and mark off the shape the deck will be. Now unscrew the deck, and with a sharp, strong-bladed penknife, cut the deck *outside* the mark made after putting the deck down on the board it was glued upon. The stern may now be finished by glueing pieces of the planks on to the oak shape, and so hiding the screw by which it is fastened to the stern post, and when quite dry the edges may be trimmed up flush with the side planking.

The planking being all fastened on, the boat may be removed from its cradle, turned over, and the irregularities, screw heads, etc., removed with a file. The whole boat, especially where each plank meets its fellow, should be filed smooth, each seam examined, and if any slight gap be present, filled with putty, the whole sanded well, especially the edge of the stern, to round the edge well; the cut-water shaped so as to be sharp, and the front half of the keel slightly tapered. I found a half-round file

excellent for this purpose. The deck may be finished according to fancy. If the boat is only for sailing, it is better not to put a well (though the yacht from which these lines are taken possesses one), which I found a great nuisance to make properly watertight, as it has to be made after the deck is finally fixed on. The directions for ballasting and rigging are excellently described in *AMATEUR WORK*, Nos. 48 to 51. If there is any part of this not quite clear, I shall be happy to explain more fully through the medium of "Amateurs in Council." If any reader manages by means of these directions in making a boat to sail as well, and look as pretty as mine, I shall have obtained all the reward I require. Before ending, I should say that it seems to me a great shame to paint a boat made of this oak planking; two coats of well-dried varnish makes the whole boat as tight as a bottle, and a thing of beauty.

## A COMPACT FOLDING-CHAIR.

*By CLERICUS SECUNDUS.*

**R**EADERS of *AMATEUR WORK* are so often treated to ideas both novel and ingenious, that perhaps some disappointment may at first be felt at the sight of the present humble claimant to favourable notice.

Moreover, without quoting Solomon on the want of originality in things mundane, or appealing to the all-inventiveness of John Chinaman, Esq., my poor chair may easily be proved to be only a reproduction. To all captiously-inclined critics, if such there be, I cry *peccavi!* and beg them to pass on.

The plain truth is that, having come across a chair like the one here described, and having found it to be well within the powers of the veriest tyro in carpentry (myself to wit), I venture to recommend it to the readers of *AMATEUR WORK* as once again meeting that "long-felt want" which, so often satisfied, is always cropping up again.

Doubtless we have all and often wished for a comfortable portable chair. The ordinary camp-



stool is portable enough, but for comfortlessness surely carries the palm; woe unto the unfortunate with a weak back who is compelled to occupy such a seat for any length of time. Nor does it much improve matters to prolong two of the legs, and nail a strip of canvas across from one to the other, although this apology for a back largely does away with the portability which is the camp-stool's chief recommendation. The ordinary folding-chair, on the other hand, may meet every requirement in the way of comfort, but is cumbersome to carry, and difficult to stow away when travelling.

The "compact folding-chair," on the contrary (name not registered according to Act of Parliament), folds away as closely, and is as portable as the camp-stool, though of course somewhat heavier; whilst for sitting (not reclining) purposes it is all that can be wished for in point of comfort.

As to the materials of which the chair shall be made, the reader must consult his pocket or his taste. Of course the harder woods—beech, for instance—are better, but good pine will answer the purpose, though in that case it will be safer to slightly increase the breadth and thickness of the several parts. Assuming, however, that one of the harder woods be selected, let the stuff be 1 inch thick in the rough; the planing up will reduce it to something like  $\frac{3}{4}$  inch, which will do nicely for nearly all the pieces of which the chair is composed.

Now to commence operations. We will begin by making the improved camp-stool, which (literally) forms the basis of the chair. From the planed stuff just mentioned cut off two strips 24 inches long, and a trifle over  $1\frac{1}{4}$  inches broad, so that when squared up they may be just that breadth. The edges of these, as of all the other pieces, may either be chamfered or slightly rounded off. These two pieces (Fig. 1) will form the two legs which support the seat in front. For the legs which support it behind, and at the same time carry the back, two pieces will be required, 21 inches long and 2 inches wide. The legs themselves are only  $1\frac{1}{4}$  inch, but the extra width of the stuff is necessitated by the curved shape of the legs. The shape of these latter will easily be understood by reference

to Fig. 2. For 11 inches they are straight, then they dip down till at 16 inches they are  $\frac{5}{8}$  inch below the straight line, rising again  $\frac{3}{8}$  inch at the end.

The front and back legs may now be joined, the front of junction, as measured from the bottom, being, for the straight leg, 13 inches, and for the curved one 12 inches. It will be observed that the hole in the curved leg is not in the centre of the wood; it must be bored as near the front edge (say  $\frac{1}{2}$  inch) as is consistent with solidity. For these and all the other fastenings the amateur must act upon his own judgment. Stout  $1\frac{1}{2}$ -inch wood screws might do, but would be apt to require screwing up tight from time to time. If screws be decided on, and if the amateur has access to a lathe, the screws had better be  $1\frac{1}{4}$  inches only, and sufficiently countersunk to allow of small buttons being glued over the hole. This will help to keep the screws in place. Bolts might be used instead of screws, and would be stronger, doubtless; but would not be altogether free from a similar drawback. The best method will undoubtedly be to rivet them, a washer being inserted under the hammered head (I am not acquainted with the technical term), to prevent it from eating its way back into the wood. This rivetting may, if considered more convenient, be postponed until the next operation be completed.

In either case, the two sets of legs must now be joined together to form the framework of the stool. For this purpose two pieces of wood will be necessary, one  $15\frac{1}{4}$  inches, the other  $13\frac{1}{2}$  inches long. These had better be of hard wood, whatever be the material of which the chair be composed, and must be 1 inch by  $\frac{3}{4}$  inch. They must be strongly mortised into the legs about 1 inch from the end. I omitted to mention that the curved legs must be rivetted so as to be on the inner side; it will then follow that the longer cross-piece will be needed to fasten the straight legs together, and form the front of the chair. As these cross-pieces must present a flat surface when the chair is open, it will not do to cut the mortises square with the legs. If these are already rivetted, it will not be difficult to find the exact angle required.

Let a string be fastened to the legs, back and front, at 1 inch from the top, and let the length of the string (or the distance between the legs at this point) be 12 inches. The string, when drawn taut, will give, with the slope of the legs, the angle required, or, in other words, the top and bottom of the mortise must be parallel with the stretched-out string.

In the measurements given of the cross-pieces, only  $\frac{1}{2}$  inch has been allowed at each end for the tenons, in order that the latter may not show through the legs. Should, however, the amateur not feel equal to cutting the required mortise neatly, and prefer to cut it right through the leg,  $\frac{1}{2}$  inch must of course be added to the total length of the cross-pieces, and each tenon be  $\frac{3}{4}$  inch instead of  $\frac{1}{2}$  inch. The bars joining the legs at the bottom must be of the same length as the above, but need not be as thick. Indeed, in my chair they are round bars of  $\frac{1}{2}$  inch diameter only. Being round, the mortising presents no difficulty, as the mortise can be made with a brace and a bit slightly less than the end of the bar. If not done already, the two sets of legs must be rivetted at this stage.

The seat is the next item on the programme. Get a piece of carpet  $19\frac{1}{2}$  inches long. The front of the seat being wider than the back, the carpet will have to be about 12 inches at one end, and  $14\frac{1}{2}$  inches at the other. The edges being "raw" (that is the term, I believe) all round, will have to be bound to prevent their fraying. The ends should be bound with American cloth, or some such material, which may or may not be sewn on beforehand, as the nails used will keep the binding in position. The tape, or whatever is used to bind the sides, will have to be sewn on. Of course this will prove beyond the skill of the most talented of amateurs, but we may hope that someone among "his sisters and his cousins and his aunts" will be found ready and willing to render so slight a service, even if "somebody else's sister" has not already acquired the right of cutting all such knots by making all such stitches. Now nail the carpet (driving the nails through the American cloth, binding and all) solidly to the underside of the cross-pieces, and we have a camp-stool as strong as we can make it.

The back of the chair next claims our attention. The two uprights (Fig. 7) are formed of strips  $20\frac{1}{2}$  inches long, and  $1\frac{1}{4}$  inches wide, chamfered or rounded-off like the rest of the chair. The top cross-piece must be  $2\frac{3}{4}$  inches broad, 16 inches long (including  $\frac{1}{2}$  inch for each tenon), and shaped like Fig. 8. The other two cross-pieces must be the same length, but only  $1\frac{1}{2}$  inches broad (Fig. 9). The three cross-pieces need not be more than  $\frac{1}{2}$  inch thick, and must be mortised into the uprights at the points shown in Fig. 7. These cross-pieces may be straight, but it will impart a better finish to the chair, and be more comfortable to the sitter, if they are slightly bent, or, better still, hollowed out in the working, say about  $\frac{1}{2}$  inch out of the straight line.

The back being completed and put away for the joints to dry, the arms may now be got ready. Two planks of wood will be needed, one for each arm, say 22 inches long by 6 or 7 inches wide. Fig. 10 will give an idea of the direction in relation to the grain of the wood in which these should be cut. I have done my best as regards the drawing, but being, unfortunately, no draughtsman, I have given in Fig. 11 the exact dimensions, and the depth of the various curves. I trust these sketches will be found sufficient. Unless the amateur has a fret saw able to cut  $\frac{3}{4}$ -inch wood, he will of course have to make shift as best he can with a key-hole or other saw. In that case it will be found safer not to endeavour to saw too near the line, and finish off with rasp and sandpaper. Bore the holes for the rivets at 1 inch from either end. By this time the back will certainly be dry. Bore two holes in each upright, one a trifle less than 1 inch from the bottom, the other  $6\frac{1}{2}$  inches from the top. Then returning to the camp-stool, bore a hole in each front leg, 1 inch (or rather less) from the top, and one in the back legs,  $4\frac{1}{2}$  inches from the top. These latter must not be in the centre, but about  $\frac{1}{2}$  inch from the back edge. Boring them in the centre would alter the angle of the back, and possibly prevent the chair from folding properly. At all events, the above is an accurate description of my own chair, and the intending chairman will do well to follow the directions given.

FIG. 10. Plan of arm.

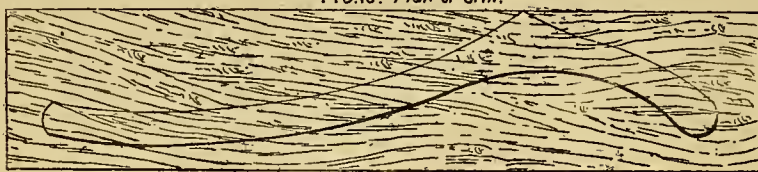


FIG. 11. Details of arm showing curves.

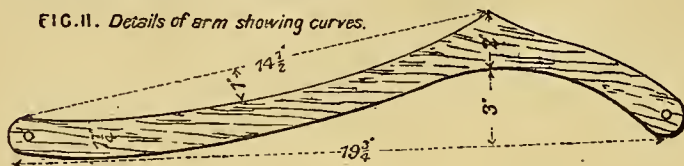


FIG. 2. Leg supporting back of seat - left side - Two needed.

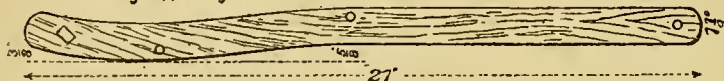


FIG. 1. Leg supporting front of seat - left side - Two needed.

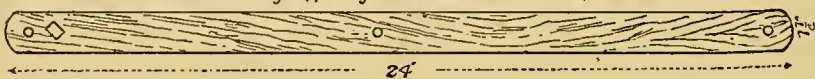


FIG. 3. Long cross-piece supporting carpet in front.

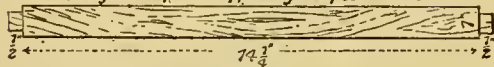


FIG. 4. Short crosspiece supporting carpet behind

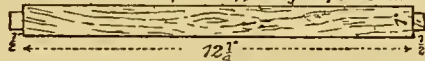


FIG. 8. Top crosspiece for back.



FIG. 9. 2nd &amp; 3rd crosspiece for back - Two needed.

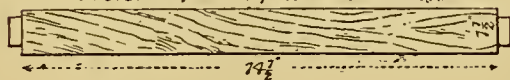


FIG. 7. Upright for back - left side - Two needed.

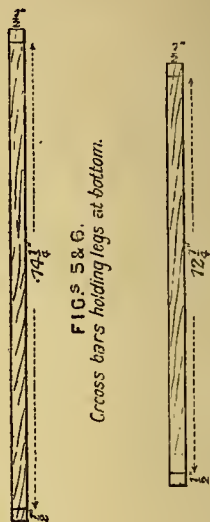
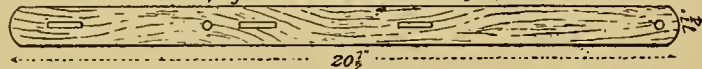
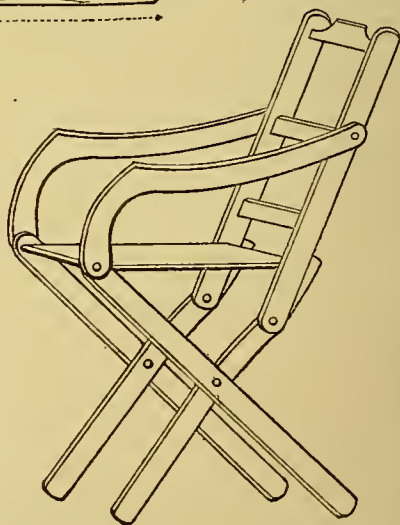
FIG. 5 & 6.  
Cross bars holding legs at bottom.

FIG. 12

Sketch of chair complete.  
1/12th actual size.

FIGS. 1 TO 11 ARE ON A SCALE OF  
2 INCHES TO THE FOOT, OR ONE-  
SIXTH ACTUAL SIZE.



Nothing now remains but to fasten the various parts together. Rivet the back to the curved legs, likewise the arms in their places, and the chair will appear as in Fig. 12. To close it you lay hold of the seat front and back, and close it as you would a camp-stool; the back falls backward, and, as well as the arms, lies close alongside the legs, making as compact and portable a chair as can be desired.

So much for the joinery involved in our chair. As to the decorative part, who would venture to dictate on so delicate a point? Suffice it, on this head, to say that mine is simply stained and varnished. There are, however, sundry modifications in point of construction which it may not be superfluous to point out.

The above chair is simplicity itself, and is specially intended for travelling purposes; but it may be so modified as to form a really handsome article of furniture. For instance, if the amateur has a lathe, he can, instead of the plain pieces across the back, cut the top one out more elaborately, and turn, say, five spindles and fix them vertically between the top and bottom cross-piece. Again, the top cross-piece and the arms may be carved, should the amateur have taste and talent that way. Or, finally, not to exhaust all the possibilities of the chair and the editor's patience at the same time, both back and seat may be made gorgeous by replacing the wooden cross-pieces and carpet strip by plush. Let the seat be made of three equal strips in assorted colours, sewn lengthwise of course, and let the back be adorned with a design embroidered in coloured silks, and the chair will make a fit throne for the presiding queen of the household; and "I shall not have lived in vain."

AN EXCELLENT CEMENT for repairing broken alabaster and marble ornaments may be made from equal quantities of melted beeswax and resin and plaster of paris or calcined magnesia.

BEFORE repapering over varnished paper, size with glue size; when dry, rub down with sand-paper, then hang the paper. Fill up broken portions of the wall with plaster of paris, or paste over with muslin or strong manilla paper.

## ELECTRIC TOY MAKING.

### THE ELECTRIC LIFT.

By ROBERT W. COLE.



SIDE view of this electric toy, the construction of which is extremely simple, is represented by Fig. 1. The whole apparatus rests upon a base, A; to this are fastened four square wooden rods, B B (only two are shown in the figure), which extend to the top, and form the framework of a tube in which the lift works. About 6 inches from the top of the tube a platform, C, is fastened, which is intended to represent a landing-stage. A carriage, E, slides up and down between the four wooden rods, and has a cord, G, attached to it, which passes over the pulley, F, fixed at the top of the

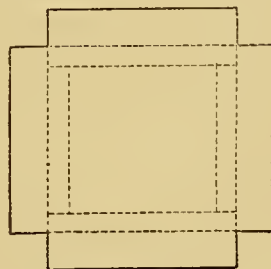


FIG. 2.—SHAPE OF BOTTOM AND TOP OF CARRIAGE.

tube; the other end of the cord, after passing over a guide pulley, H, is wound round the axle of the electromotor, D.

We will now proceed to construct the lift. The baseboard is about a foot square, is made of  $\frac{1}{2}$ -inch material, and has its edge neatly bevelled round; cut out four rods of wood  $\frac{1}{2}$  inch square and about 3 feet long, and fasten them down at equal distances apart in the middle of the base-board, so that they form a square the side of which measures 2 or 3 inches long. They can be fastened down by small galvanized iron clamps, fixed into their ends and into the base-board. If they are not made sufficiently secure by this means, they may be further strengthened by means of braces, or by small blocks of wood glued on to the base, so as to press against them. Next fasten a piece of wood across the top ends,

so that they are kept at the same distance apart as the bottom ends, and nail either some perforated zinc, wire gauze, or thin wood, across the pieces of wood, so as to form a square tube; leaving, however, an open space 4 inches long at the lower end, and another, 5 inches long, at the upper end. Next make the platform, c; the bottom of this is made of a piece of thin wood about 9 inches square, and having a square hole in its centre large enough to pass over the tube. It is fixed at a distance of about 5 or 6 inches from the top of the tube, by braces fastened underneath, and by small pieces of sheet-brass, first of all, fastened on to it, and then on to the tube; and its edge is surrounded by a fence of wood or perforated sheet-zinc about  $1\frac{1}{2}$  inches high.

The next part which we will make is the carriage, which slides up and down in the tube. This is made in the shape of a box, and has its top and bottom cut into the shape shown in Fig. 2, so that it can slide up and down between the four wooden bars which fit into the places where the corners are cut away. The four pieces of wood which form the sides are fastened in the position indicated by the dotted lines in Fig. 2. One side of the carriage has a small doorway cut in it, into which a door is fitted with hinges; when the carriage is completed, it is inserted between the four wooden rods by removing the piece of wood which holds their upper ends in position. If it does not slide up and down very easily, it should be removed, and the places in the top and bottom, where it comes in contact with the wooden rod, should be slightly filed. A small eye fastened into the middle of the top completes the carriage. We must now fix the electro-motor in its place. After what has already been said about

electromotors in AMATEUR WORK, the construction of the one used here need not be dwelt upon at length, except that it must be reversible, and must have a drum fastened on to its axis. The best cord to use is the thin string which is used for fishing; one end is made fast to the drum, and the other, after passing over the guide-pulley (H) and another pulley (F), fixed at the top of the tube, is tied

on to the eye which was fixed on to the top of the carriage, a hole being

previously bored in the piece of wood at the top of the wooden rods, to allow it to pass through. The pulley wheel, F, is fastened in such a position that the string passing over it may pass through the hole bored in the piece of wood at the top of the tube, and not rub against it. A pair of binding screws are fastened on to the base; from one of these a wire goes direct to the electro-motor, and from the other a wire goes, first, to a small handle (I, Fig. 1), used for turning the current on and off, and thence to the electro-motor. Another handle, which works a catch placed in the tube, so as to keep the carriage from falling when it has reached the top of the tube, is placed beside this one.

A few touches of paint and varnish, applied according to taste, render the construction of the lift complete. The bat-

tery power required, since the carriage is very light in weight, will be very small, being only about one  $\frac{1}{2}$ -pint size bichromate cell.

**BOOKBINDERS' GLUE.**—Use best carpenters' or white glue, to which, after soaking and heating, one-twentieth its weight of glycerine is added.

IRON may be cemented into wood by dropping into the recess prepared in the wood a small quantity of strong solution of sal-ammoniac.

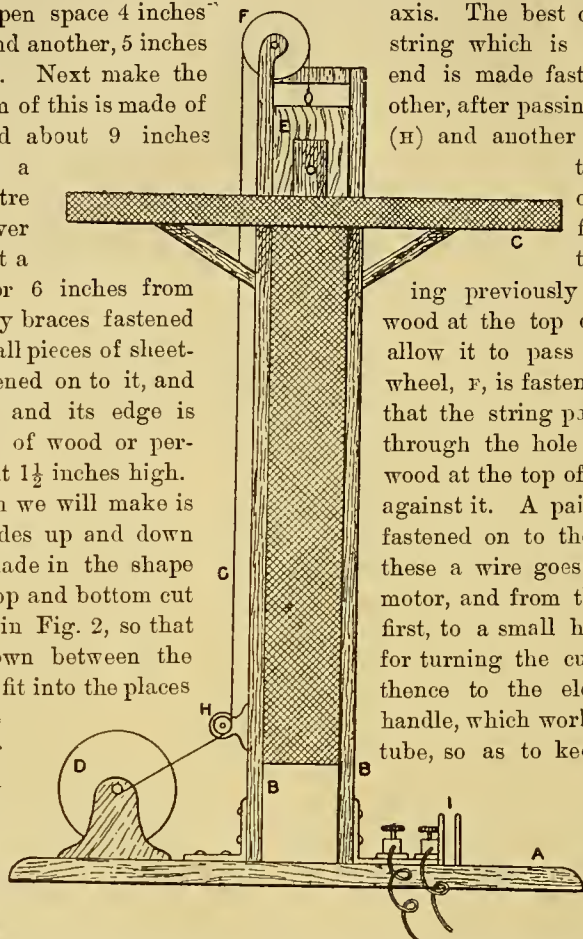


FIG. 1.—GENERAL VIEW OF THE LIFT; A, BASE; B B, SQUARE STRIPS OF WOOD; C, PLATFORM; D, MOTOR; E, CARRIAGE; F, PULLEY WHEEL; G, CORD; H, SMALL PULLEY WHEEL; I, HANDLE TO TURN ELECTRICITY ON AND OFF.

## AMERICAN ORGAN BUILDING.

By THOS. L. WINNETT.

## IX.—STOP ACTION.



WE have now come to what I consider the most difficult part of our task, viz., the connection of the various actions to the stop knobs. It is a rather complicated piece of work for the amateur to do successfully; but I hope with a little of the patience we have had to exercise in the various other manipulations that the difficulty will be surmounted. That it can be done by an ordinary worker I am convinced from my own personal experience, but it was the most tiresome job I had in the whole of the work connected with the American organ.

We must, however, conquer these little difficulties if we mean to finish our instrument, and make it as perfect as possible; so let us to work at once.

The first things to procure are the stop knobs and rods. They can be purchased of Mr. Marsh (whose address appears in Chapter I.), with the names already engraved on celluloid fronts, for 6d. each. We shall require twelve, with the following names:—

| TREBLE.                    | BASS.                   |
|----------------------------|-------------------------|
| 1. Vox humana.             | 7. Sub-bass.            |
| 2. Octave coupler.         | 8. Octave coupler.      |
| 3. Cello (or violoncello). | 9. Dulciana.            |
| 4. Principal.              | 10. Viola.              |
| 5. Melodia.                | 11. Diapason.           |
| *6. Swell diapason.        | *12. Swell violoncello. |

Those stops marked with an asterisk may be omitted if it is required to reduce the expense. They are not essential to the power of the instrument.

Having purchased these, we must first drill twelve holes in the front stop rail, rather larger in diameter than the rods themselves, because a bushing of red baize has to be inserted to make them work easily; also the same number of holes must be made through the back stop rail to correspond with the front ones. The best way to get these accurately will be to take an impression by means of a piece of thin paper rubbed over the front holes after they have been

bored, for it must be borne in mind that the back holes *must* be exactly in a line with the front ones, else the stops will not work at all satisfactorily.

Bush the rear holes in the same manner as the front ones with red baize; it is best to do this with half-cold glue, using a very little at the time, otherwise the glue will ooze through the baize, and make the bushing hard. All bushing should be done in this manner to be satisfactory.

We shall next want some more iron wire, No. 12, the same as used for the octave coupler wires; this is for the mute levers. Four levers will be required for the front mutes, two of which will have to be bent in the form shown at A (Fig. 71A). Flatten the end, B, and drill a small hole through it close to the end; the other end, C, must be sharpened to a point. The other two levers for the bass portions of the front rows are of the same form, with the exception of the arm, B, which is bent in the reversed direction; the form can be seen by looking at the illustration from the back of the page; but the design of the alteration will soon be apparent in the working of the stops.

Having bent those for the front rows satisfactorily, we can turn our attention to the back row. Fig. 71a will illustrate the bending of the wire, which is somewhat similar in form to the front rows.

The mute levers, when bent, will have to be driven into the separate pieces of wood forming the mutes in the manner shown in Fig. 71, and at such a distance from the outside end of each mute, that the part, B, projects through the key-bearer a little over  $\frac{1}{4}$  inch. A bushed hole will have to be made through the bearer for this purpose. In boring the holes in the mutes for driving the wires in, it must be borne in mind that the hole should be commenced as close to the *back* top edge of mute as possible, the direction of the hole being towards the bottom *front* edge (C, Fig. 71); this allows plenty of purchase for the wire without running the risk of splitting the mute.

The lever for lifting the sub-bass action into position will be in the same form as the bass portion of the octave coupler action. Bushed



holes must, of course, be made for each lever through the key bearers.

Having completed this part of the wire work satisfactorily, after testing each lever to see that it works easily, we may proceed with the levers for attaching to the stop rods. If you will refer to Fig. 70, where is given a top view of the stop board with the levers placed in position, perhaps you will the better gather the idea of the action. Supposing that we begin upon the stop No. 2, the nearest lever to the back stop rail (Fig. 72). This lever will be a guide for all the others, so I shall only give illustrations of this one, the others only differing in the *length* of the wires, as you will no doubt see by referring to Fig. 70. The wire used should be moderately stout, and should bend without breaking. Brass wire is very good for the purpose. By means of an iron vice bend the wire to the shape shown in Fig. 72. The length or distance between the two bends will be ascertained by placing the stop

rod (in this case the octave coupler treble) into its hole in the stop rail. This will show the position of the bend *B* (Fig. 72), which should be immediately under it; the other bend for the full organ should come in the position shown at *c* (Fig. 72). Now, the only difference between this lever and those for the other stops will be that the distance between the two bends will vary with each stop. *B* should always be made under its own stop rod, while the bend, *c*, for full organ must always be at the same distance from the end of the stop board, also must correspond exactly in height with one another, as a lever comes from the knee swell to push all the bends, *c*, down at once, thus bringing the full organ into play. Fasten the levers down upon the stop board with small blocks of wood (Fig. 73), bushed, placed at convenient intervals, but preferably close to each side of a bend, in order to take the strain. To connect

the stop rod with this wire work we shall have to insert into a slot made in the rod a small fork made of beech (Fig. 74), bushed in the fork part with red baize. The slot in the stop rod must be made similar to Fig. 75, which shows a section taken in the middle, and a view from underneath; for the slot need not appear on the top surface of stop rod, or it will greatly interfere with its appearance. The fork should be placed in the slot thus made, and should work freely therein upon a pivot made of wire driven through the rod at *A*. You will easily see that the slot will differ in position with each stop rod, according to the position of the bend *B*,

but must always be kept about  $\frac{3}{4}$  of an inch to the rear of the bend when placed at the angle shown at *D* (Fig. 72).

The action, then, when a stop is drawn will be this: the fork attached to the stop rod should press down, by its forward action, the lever

*B* (Fig. 72), and this being connected at its tail, by means of a thin wire, to the lever below, attached to the mute or coupler, as the case may be, it causes the mute to open, or the coupler board to rise, thus opening the stop; as soon as the stop is withdrawn, the mute, by its own spring, closes, drawing up the lever again in place. The distance the octave coupler board is allowed to rise will be controlled by the length of the upper lever or stop wire, and will differ in each instrument; it must, therefore, be found by experiment.

Having once mastered the difficulty of the first stop wire, it will be easy to apply the action to the remaining stops. The bend of each stop wire at the tail end will differ in angle with each stop; but all the various bends are shown in Fig. 69, in which illustration is also shown the connection with the various mutes, octave

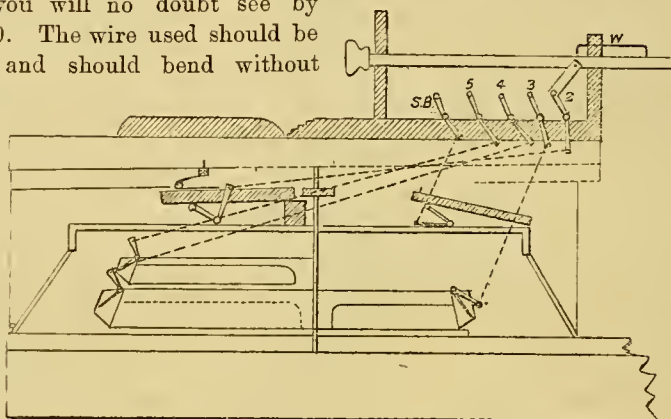


FIG. 69.—GENERAL VIEW OF STOP ACTION.

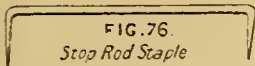


FIG. 76.  
Stop Rod Staple



FIG. 73.  
Block for fixing Stop wires  
Actual Size



FIG. 74. Fork to be fitted  
in slot made in Fig. 75.

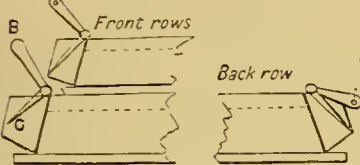


FIG. 71. Method of Fixing levers in mutes

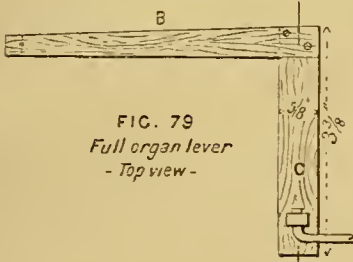


FIG. 79  
Full organ lever  
- Top view -

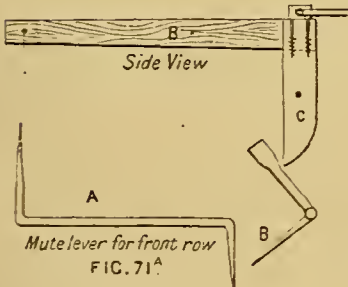


FIG. 71A.

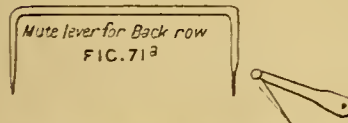


FIG. 71B.



FIG. 75. Slot to be made in Stop rod.

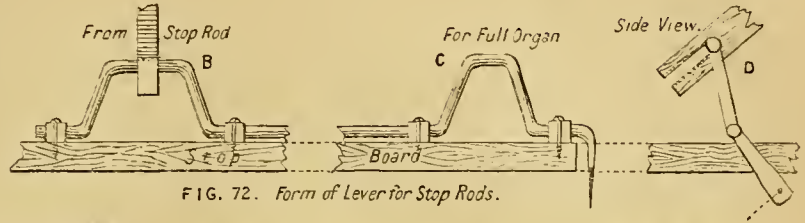


FIG. 72. Form of Lever for Stop Rods.

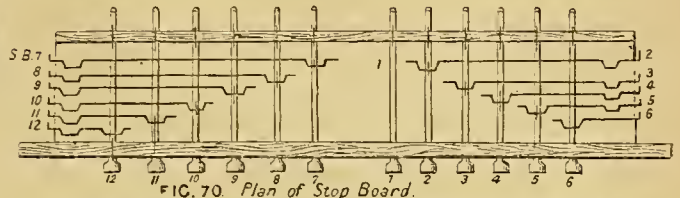


FIG. 70. Plan of Stop Board.

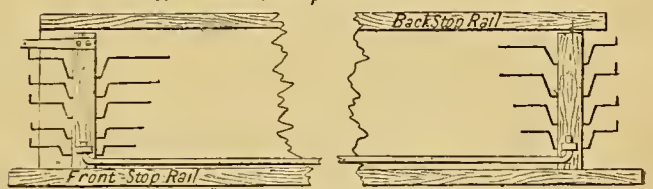


FIG. 78. "Full organ" Action. Top View

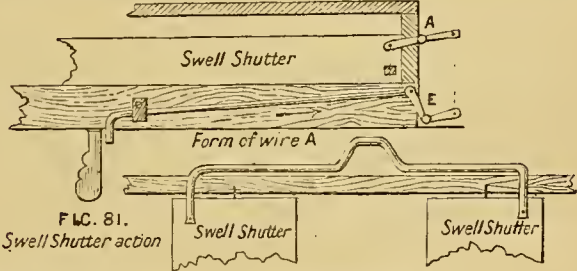


FIG. 81.  
Swell Shutter action

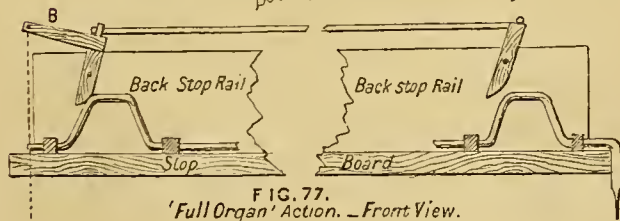
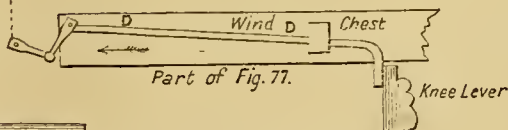
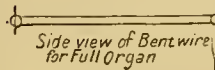


FIG. 77.  
'Full Organ' Action. - Front View.



Part of Fig. 77.

Knee Lever



Side view of Bent wire  
for Full Organ

FIG. 80.  
Bent Wire for Full Organ  
Full Size.  
See W Fig 77.

coupler, and sub-bass actions by means of thin wires.

In placing the stop handles, be careful to keep them in the same order as numbered in Fig. 70, or you will be likely to make a mistake. The numbers correspond with the list at the commencement of this chapter. Also care must be taken that all the bends in the stop wires for full organ should come in a line at each end of stop board.

The connection of the *vox humana* fan with its stop rod is very simple, the only thing to be done being the joining of the arm attached to the fan with the end of the stop rod by means of a screw into the latter, a washer being inserted between the arm and the rod.

The distance each stop rod is to pull out for the effective working of its lever must be ascertained by experiment, and when found, a wire staple (Fig. 76) is to be driven into the top of the stop rod at the back (see *w*, Fig. 69). This staple works in a bushod saw-cut made in the back stop rail to receive it.

The stop wires in the bass half of the stop board must be placed closer together than the treble side, on account of there being an additional wire in the sub-bass action.

Now for the full organ action. Figs. 77 and 78 will give a general idea of its working. First, a wooden lever must be made (Fig. 79) to actuate the wires, an arm, *b*, projecting out at one end. A similar one is made for the treble end, but without the arm. Both parts are pivoted at *c* into the back and front stop rails, and each placed in position just a little to the left of the row of bends in stop wires (see Fig. 77), touching them in such a manner that when the arm, *b*, is pulled, the levers are pressed down altogether. The wooden levers are both connected together by a thin iron rod, fastened to the top of each, so that when the left arm is pulled the treble side acts with it, and all mutes and couplers are opened at once.

I have tried to make this matter of the stop wires as plain in writing as I can; but if there should be anything not understood at once, a careful study of the various illustrations will no doubt get over the difficulty.

The next work will be to connect the full

organ lever with the knee swell. A bent wire, in the form of Fig. 80, is fastened on to the left side of the wind chest, one arm of the wire being placed immediately under the arm of the wooden lever above; the other arm of the wire is brought round in front of the wind chest, and is connected with the long stout wire, *d*, Fig. 77. Referring to the same figure, when the knee swell is pressed to the left it pushes forward the wire, *d*; this in its turn actuates the arm, *e*, and the movement is communicated to the wooden lever on the stop board. Do not forget to bush, with baize or cloth, all places where the wires touch the wood, as well as the blocks by which they are fastened down, and it would also much contribute to the free working of the wires if they are sent, after being fitted, to Sills and Co., Coventry, or any bicycle platers, to be coppered or silver-plated; the cost of the former is very trifling, but silver-plating has a better finish, if the extra cost can be afforded.

The rod for opening the swells is placed on the opposite or right-hand side of the wind chest (Fig. 81). The action is very simple, and hardly needs illustrating; but I have given one, so that there need be no mistake or uncertainty about it.

The wire (*d*) is similar in shape to that used for full organ, as also is the cranked wire, *e*. The right-hand key bearer has a bent wire shaped as at *A* in Fig. 81, and the two projecting arms raise the two swells, at one and the same time, whenever the right-hand knee swell is pressed to the right.

I might mention here that if it is wanted to divide the swell shutters into bass and treble portions, so as to be separately controlled by stops, a saw cut must be made in a diagonal direction through the shutter; that is, in cutting, the saw must not be held upright, but inclined towards the right. This has the effect of raising the bass shutter when the treble side is lifted by the knee swell, but, nevertheless, the bass half may be separately raised by a stop if wanted; but this combination is not often required, although sometimes met with in American organs. The better method for increasing the variety of combination will be to have a stop controlling each swell shutter, or, in other words, to lift the back and front shutters separately,



the shutters being left uncut. The lifting of the rear shutter, leaving the other closed, would have the effect of a 'cello solo to a soft bass, or, on the other hand, a very brilliant effect can be obtained by causing the front shutter alone to be opened, and thus keeping the 'cello subdued. If the shutters are thus to be divided, a better effect will be obtained if a thin partition be glued on the under part of swell cover, to separate the sound. Many are the various effects to be obtained with a little ingenuity and experiments on the part of the organ builder, but I can only spare room just to mention one other, which you must elaborate for yourselves. It is this: the power of each stop may be controlled from forte down to piano by adding stops which open the mutes but a short distance, thus regulating the amount of air let into the reeds. These stops have various names given to them, but more generally the word "dolce" is added to the name of the stop acted upon. Supposing, now, that a soft diapason bass is required, the alteration is made in the stop wire, an extra bend being added just under the additional stop rod, a difference being also made in the fork acting on the wire, which has a somewhat longer slot made in it, so that the bend is pushed down but a short distance, thus causing the mute wire below to lift it a correspondingly short degree. The reader will easily see in how many stops this action may be applied, so that if he pride himself in a good show of stops, the whole name board may be filled with handles from end to end without additional expense.

Now I do hope I have made the matter of the stop mechanism plain to everyone. If I have not, do not be afraid to ask any questions about anything you do not understand, through the usual medium.

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WHITE GLUE.—A writer in the *Moniteur Scientifique* says that to add oxalic acid and white oxide of zinc in the proportion of one per cent. to glue gives a whiter and clearer product than any of the measures now in use. The glue should first be reduced with water and heated to a thick syrup, and the chemicals added while the mass is hot.

## A SINGLE LANTERN DISSOLVER.

By "TWIST DRILL."



MOST of our readers, on seeing this heading, will accuse me of promising more than I can perform, and deny that it can be possible to dissolve one view into another without the customary pair of lanterns, or, at least, pair of optical systems. Undoubtedly; but without attempting to obtain the complete dissolving effect once so much admired, but which most people now seem just a little tired of, there seems room for an effort to improve on the usual order of things at a single lantern exhibition. Slide No. 1 is snatched away with the motion of an earthquake or a Channel steamer, and a brilliant white disc is left, on which soon appears slide No. 2, with a series of ineffectual hops, by the aid of which it reaches, more or less, its intended position on the screen. Capping the lens during this, or employing the brass shutter often found in place of a cap, is rather better, but also rather troublesome, at least more so than the use of the attachment I am about to describe. The shutter of it is by no means original; but I believe the combination of such a shutter with tinted glass and the usual sliding carrier (for photo slides), is more or less novel. The advantages of a single lantern are many, and though the owner of one is unable to delight the juvenile portion of his audience with "effects," he can compete with his brother of the twin instrument in every other field, and has an immense advantage over him in portability of apparatus; and last, but in my opinion not least, in the power of using the ethæo light, so difficult to manage in a bi-unial. To him, therefore, the description of the before-mentioned "dissolver" may prove of service.

The most perfect shutter to use in this instrument would be an Iris diaphragm (four leaves would be sufficient) in the middle of the front lens tube; but in practice it works well enough with the double shutter illustrated in front of the lens. My own shutter has an aperture of  $1\frac{3}{4}$  inches full, but might with advantage be a little larger; however, I will describe its construction in this size, leaving the

maker to vary its dimensions as necessary to suit his own lantern. To begin with, the foundation of the instrument, as shown in Fig. 1, half-size, *i.e.*, to a scale of 6 inches to the foot, consists of a piece of  $\frac{3}{16}$  mahogany, 7 inches by  $3\frac{1}{2}$  inches; this should be  $\frac{3}{16}$  thick when planed up, and requires a hole cut in its centre 2 inches diameter.

The shutters had better be made next. They may be of ebonite or ferrotype plate, or even of veneer, if nothing else is at hand. I made mine out of a broken photographic dish, and cut them with scissors after softening with a hot iron. If this is done, they should be allowed to get cold under pressure, to flatten them. The breadth is  $2\frac{1}{4}$  inches, and total length  $4\frac{1}{2}$  inches, including the ears at A and B, Fig. 1. When they are cut out and filed smooth on the edges, the holes are to be cut with

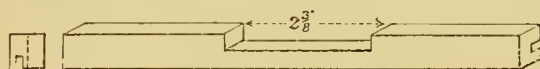


FIG. 2.

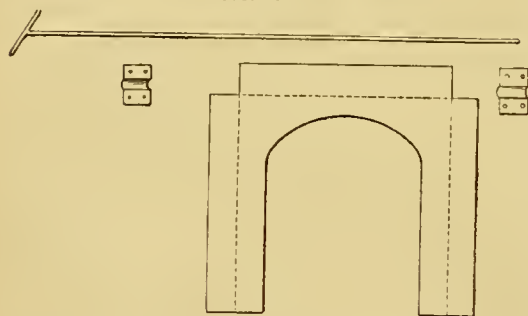


FIG. 3.

a fret saw, or turned,  $1\frac{3}{4}$  inches diameter; the centres of these should be marked off from the holes at A and B, by which the two leaves are attached to the cross-bar. Leaf A has the centre of its aperture  $3\frac{1}{4}$  inches, and leaf B  $2\frac{1}{2}$  inches from these holes.

Next, the two pieces, of which one is shown in Fig. 2, are to be cut,  $\frac{3}{8} \times \frac{7}{16}$ , and 7 inches long, and a groove sawed in the narrow side of each, leaving a  $\frac{1}{16}$  wall on the front side; this is to take a piece of ground or coloured glass, and

may be a little over  $\frac{1}{16}$  inch broad, by about  $\frac{1}{8}$  deep. Now, on the side adjacent to the grooved side, but on the thick wall of the groove, a piece  $2\frac{3}{8}$  long by about  $\frac{1}{8}$  deep, is to be cut

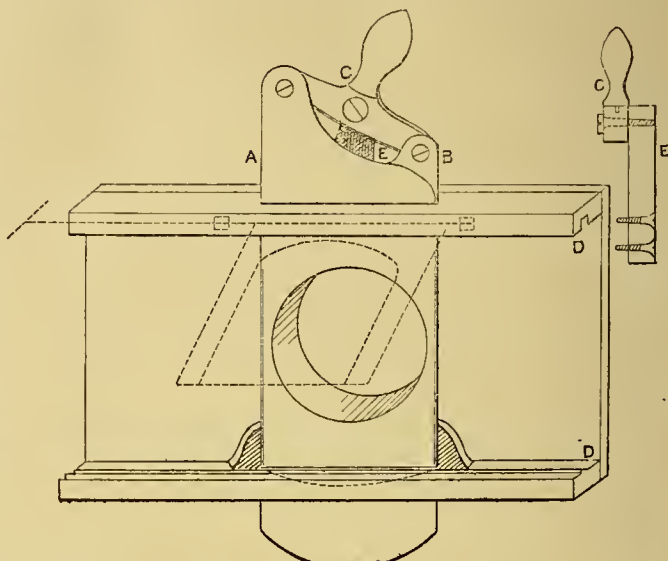


FIG. 1.

out, so that when the two strips are screwed to the baseboard with the grooves facing each other, they will leave slots in which the shutters can slide with a little side play. Two small triangular blocks may be necessary, as illustrated in Fig. 1, to confine their motion; this is rendered necessary by the width of the baseboard, which is to allow the use of a frame carrying coloured gelatine in the grooves, without the inner edges of the frame overlapping the centre aperture.

The crossbar, o, is of brass  $2\frac{1}{4}$  inches long, with a hole drilled  $\frac{1}{8}$  inch from each end to tap to receive screws, on which the shutters hang. There is also a clearance hole in the centre for a similar screw, which has a hole tapped for it in the brass upright, E, 2 inches long at the back; this is attached to the wooden base by two  $\frac{1}{4}$ -inch screws.

The brasswork is made of  $\frac{1}{8}$ -inch sheet, except the handle, which is best turned out of a bit of  $\frac{3}{8}$  rod. It should be rather heavy, so as to keep the shutters open or closed firmly, as the case may be.

A screw should be put in vertically under each end of the cross-piece, *c*, for it to rest on at each end of its travel; these can be adjusted so that the aperture is completely open in one position, and just closed in the other. When this adjustment has been made, a small circlet of leather or felt is to be cemented on the screw-heads, to avoid the rattling that would otherwise be a nuisance in the lecture hall. It is hardly necessary to mention that the dissolver is attached by a flange, of brass or wood, at the back to the lantern objective.

The only remaining parts to be completed are the tin frames for the slide-tinting arrangement. One should be made of a size to slide in the grooves of the frame, open on one side, that the coloured gelatine employed may be moved across the aperture without a black bar—the edge of the frame—preceding it. Two more, one of which is indicated by dotted lines in Fig. 1, should be cut out of tin or ferrotype plate, as Fig. 3. The top edge is turned down over the brass wire, with a cross handle or loop bent at its extremity, and the other two sides are turned over, leaving room to slip in a sheet of coloured gelatine. Two little brass plates, also appearing in Fig. 3, serve to attach the wire to the base.

The other frame is fastened in the same way to the lower edge of the base, and folds upwards over the aperture. By the use of orange and bluish gelatines in the respective holders, a sunset effect can often be given to a plain side, and the use of a third tint in the sliding frame enables endless variations to be made. A square of celluloid, such as is used for the celluloid films, turned over the lens before changing the slide, gives a sort of dissolving effect. The half closing of the shutters adds to this. For use with this dissolver, the "Lightning" double carriers are very effective; they have a sliding frame holding two  $3\frac{1}{4}$  slides, which can be changed almost instantaneously by moving it across. Most amateurs will be able to make one from this description; but as they are sold at the low price of 1s. 9d. and 2s. 6d., plain and varnished respectively, by nearly all dealers in lantern apparatus, it will hardly be worth their while, and still less worth the space in "ours" necessary for a full description.

In conclusion, I may say I think that if those lanternists who do not employ one or both of these devices for slide-changing in a single lantern, will try them, they will be agreeably surprised at the improvement in effect.

It would doubtless be an advance on this if the carrier were made to automatically close the shutters at the beginning of its travel, and open them at the end; but not having had time to elaborate such an arrangement, I offer the suggestion for what it is worth.

## THE ELECTRIC BELL IN ITS SIMPLEST FORM: HOW TO CONSTRUCT IT.

By JOHN H. MILNE.

### II.—MAKING AND FIXING THE ARMATURE — THE BASE-BOARD—FITTING UP AND REGULATING.



THE armature must next be described. Obtain a piece of nice soft iron, in length a little longer than the distance between the outside edges of the poles of the magnet, say from  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inches,  $\frac{1}{8}$  or  $\frac{3}{16}$  inch thick, and  $\frac{1}{2}$  inch broad. It should also be annealed, as before described. Afterwards file it smooth, keeping the size as nearly as possible to the above dimensions. On one end solder a piece of iron or brass wire a little over  $\frac{1}{16}$  of an inch gauge, just strong enough to give a steady blow when the hammer is affixed, yet not so heavy as to be cumbersome. Solder it on to the armature *A*, as it appears at *B*, Fig. 6. Then get a piece of ordinary thin sheet brass, or, better still, tempered brass, which has far more spring than the ordinary kind, say  $\frac{3}{8}$  inch broad, 2 or  $2\frac{1}{4}$  inches long, and the thickness of a visiting card; a piece of clock main-spring will do, but it is more difficult to solder. This should be soldered on *A*, just at the shaded part in the figure. It should project at the end *c*, opposite the hammer, about  $\frac{1}{2}$  inch or so. Now bend upwards the end of the brass spring over *A*. The whole will have the appearance of Figs. 6 and 6A.

Instead of soldering, the more expensive instruments have the hammer-rod screwed into the armature, and the spring fastened to the



armature and supporting pillar by means of screws.

The hammer-head can now be made out of a piece of brass, as shown in Figs. 6 and 6A, about  $\frac{1}{8}$  inch thick, and of the size in the diagram. Make a nick across it with a file on the under side, and then solder the head on to the end of the wire B, so that the head shall be at right angles to A (Fig. 6A). The reader can easily adapt the size to the bell, when the completed machine is put in connection with the battery, for the purpose of testing and regulating the several parts.

The support or pillar for the armature follows. Bend a piece of brass  $\frac{1}{2}$  inch broad, and  $\frac{1}{16}$  inch thick, into the form of Fig. 7. Two holes will be required to admit screws (one may do), as in the figure. The spring of the armature (c) must now be soldered to the top of the support at A, the space between the armature and the spring support being about  $\frac{1}{4}$  or  $\frac{3}{8}$  inch. The height of the spring and the support being such that when the latter is screwed to a base-board the centre of the armature may be exactly the same height as the centre of the cores of the magnets when lying in position on the same base.

Next, a piece of platinum wire must be bought, about the thickness of a pin. The short line at D (Figs. 6 and 6A), which represents it in position, perhaps  $\frac{3}{16}$  inch long. It can be neatly soldered to the spring c, by a slight touch of solder, allowing, say,  $\frac{1}{8}$  inch to project, as at D.

Now another piece of brass, in the form of a knee support, must be made, (Fig. 8, F), and another piece of platinum wire soldered on the top of it, as at G, the height being so regulated that when the armature is screwed tight to a base-board, the other support, E, also being screwed down, the two platinum pieces, D and G may be enabled to form a proper contact in the shape of a cross, as in the figure.

A hole being made in F, for a screw, the armature will be finished.

If the reader has not a small drill to bore the hole through the supports, he can buy at any ironmonger's, for  $1\frac{1}{2}$ d. or 2d. each, small brass knees, or right angles used for fastening at the corners of boxes, etc.; usually these have

holes bored through them, which he will find to suit his purpose. It is a very simple thing to cut the knees down to the required height.

A piece of covered copper wire can be soldered to each of the supports for connecting up, say, 3 inches long. The wires, when soldered on, can be coiled round a black lead pencil for neatness and compactness. It is as well to draw the reader's attention to the fact that in all soldering connected with electrical matters it is important to use rosin instead of spirits, as with spirits a certain local action takes place, which interferes materially with the working of the bell.

The base-board will now be required. Procure a piece of deal or mahogany, about 6 or 8 inches long and about 4 or 5 inches broad. Round the end, so as to improve the appearance, and fasten to the top (or to each side) a brass eye to hang the bell by. The size of the base is greatly a matter of taste, some preferring more wood, as if of mahogany, oak, or such like, it has a fine appearance when polished.

It will be necessary now to procure a clock bell of about  $2\frac{1}{2}$  or 3 inches diameter. Get a cotton reel, pare down the sides towards the top, to almost the hole through the centre, as in Fig. 9. It must be such a height that, when the bell is laid on the top and the armature screwed down on the base-board, the hammer-head will be in a line with the edge of the bell, so that the hammer will be capable of giving a solid blow to the bell.

Now place the bell on the bobbin, and then put a long wood screw through the top of the bell and through the bobbin, and screw into the stand. The bell will be now firmly fixed in position.

A round-headed brass screw will have a much neater appearance than the flat screw.

Of course, a bobbin need not be used. A block of wood of the same colour as the base-board can be glued to it, as in Fig. 10. The top should be made as in the figure, to prevent the ringing of the bell being interfered with by unnecessary contact. A small screw in this case will do, but the wood should have the grain running across, as in the figure, in order that the screw may have proper hold.

The wood has a tendency to deaden the sound.

so a little piece of tin or other metal, placed between the bell and the wood, will be an improvement.

The armature and coils can now be put in their place, and must lie in the position shown in Fig. 11. In fitting the armature, it will be necessary to bend the hammer rod, as shown in the figure, and perhaps shorten the hammer lever to suit the particular case, but this and other small adjustments can without difficulty be accomplished.

The connection of the two platinum points is shown at *d* and *g*.

Here it should be mentioned that the connection, *g*, should be placed sideways, as in Figs. 8 or 11, so that it can be made to press forward the hammer to the magnets, or to ease it by allowing it to fall back, this taking the place of the regulating screw used in the more expensive instruments. The writer has often adopted this plan, and found it to act admirably.

The coils must now be placed in position. They are fixed to the base-board by a cross-piece of wood, *i*, fitting inside the rims of the bobbins, with a hole in the centre, through which a wood screw is inserted, passing between the bobbins and entering the base-board, *r*. A cross-piece similar to the one binding the coils on the top had better be inserted below the coils, so as to keep the edges of the bobbins off the base-board, as there may be a danger, in screwing up the coils, of breaking the bobbins if they have to bear the strain of the screw.

The parts should not be screwed very tightly down until they have been regulated, and the position giving the most satisfactory results obtained. When the hammer-head is pressed against the bell, the armature should allow a thin card to pass between it and the magnet. When the magnet is badly annealed and retains magnetism, it sometimes holds the armature to it. A common mode of prevention is by putting pieces of postage stamp over the poles of the magnet, but the writer does not advise this method, as it is not at all reliable; or a slight piece of wood may be glued on the bobbin to keep the armature from actual contact. Usually a piece of brass is let into the centres of the poles of the magnet, projecting

above the level of the pole, like a pinhead. It will be seen the coils can be adjusted by loosening the pressure of the crosspiece. The support, *r*, can be moved either forward or backward, as shown by the dotted arrows (Figs. 8 and 11), thus bringing the hammer closer to the bell, or the opposite. The support, *e*, can also be moved to the right or left with the like result, as shown by the arrow-heads.

In the more expensive bells the regulation is done by a screw passing through the support, tipped with platinum; the screw works against a round spot of platinum on the spring.

When the bell is subsequently joined up to a couple of good Leclanche cells, the best adjustment will quickly be found.

The wires now require connecting. The end of one of the coils at *p* (Fig. 11) should be joined to the lower terminal, *q*. The other end of the coil, *j*, is joined to *r*, and the wire from the support, *e*, carried to the upper terminal, *q*; the battery wires are joined to *q* and *q*.

Very neat terminals can be bought for 2d. each. They are various in design, one form of which is given in Fig. 12.

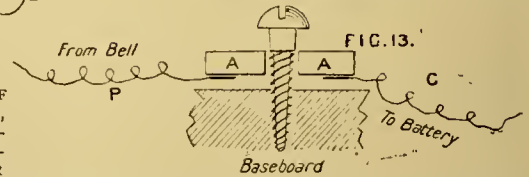
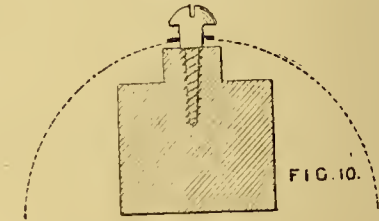
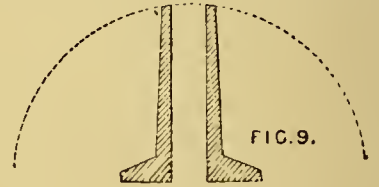
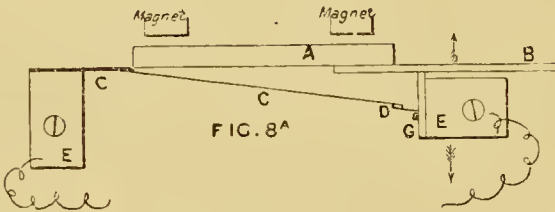
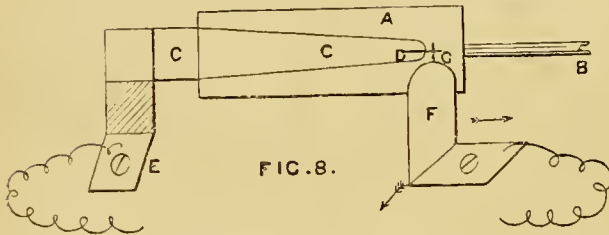
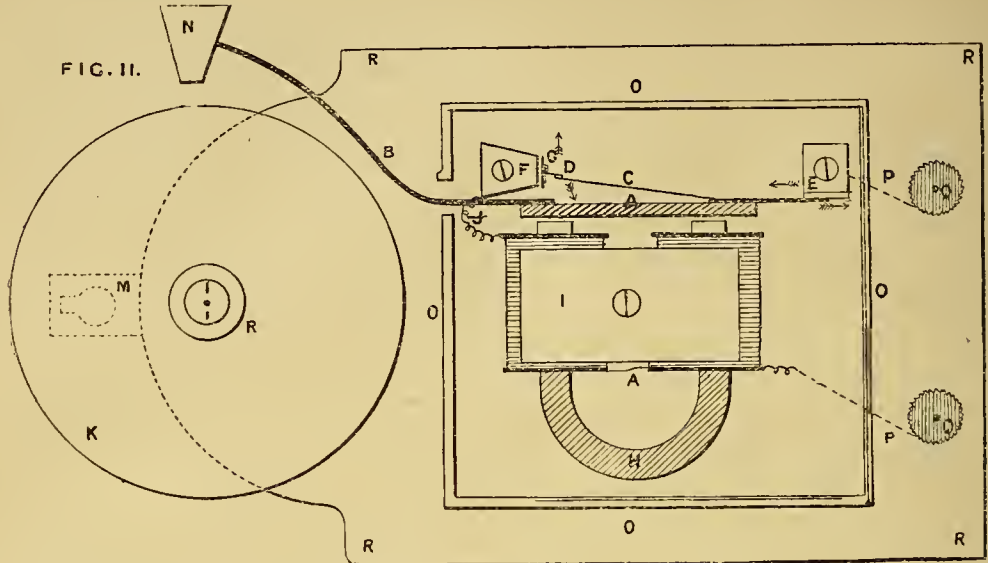
However, terminals good enough for the purpose can be speedily devised by screwing round-headed wood screws into the end of the base-board, taking them out, putting the end of the wires, *p p*, into the holes, then screwing in the screws. A good contact will be the result.

The connecting wires from the battery need now merely be wound round the screws, and then the latter screwed up to their heads, the wood thus fixing the wires.

If it be preferred, a better, yet simple, arrangement is the following:—

Get a piece of brass about 1 inch long and  $\frac{1}{2}$  inch broad,  $\frac{1}{16}$  inch thick (Fig. 13.) Bore a hole for the wood screw to go through. Solder the wire, *p* (for instance, Fig. 11), to the under side. When the bell is connected with the battery, the battery wire has simply to be put under the plate, or round the screw head, and then the wood screw screwed firmly down.

The bell, with a little adjustment, will be found to act satisfactorily when connected with the battery.



#### DESCRIPTION OF FIGURES.

FIGS. 8 AND 8A.—PLAN AND SIDE VIEWS OF ARMATURE AND SPRING; A, ARMATURE; R, HAMMER LEVER; C, ARMATURE SPRING; D, PLATINUM CONTACT WIRE FIXED TO SPRING; E, ARMATURE SUPPORT OR KNEE; F, MOVABLE KNEE FOR MAKING CONTACT WITH D, AND ADJUSTING ARMATURE TO MAGNET, WHICH, MOVED IN THE DIRECTIONS OF THE ARROWS, BRINGS THE ARMATURE NEARER OR FARTHER FROM THE MAGNETS; G, PLATINUM CONTACT WIRE. FIG. 9.—COTTON REEL OR BOBBIN WITH THE TOP RIM CUT OFF AND TAPERED TOWARDS TOP FOR SUPPORT FOR BELL; THE POSITION OF BELL IS SHOWN BY THE DOTTED SEMICIRCLE. FIG. 10.—BLOCK OF WOOD TO WHICH BELL SHOWN BY DOTTED LINE IS ATTACHED. FIG. 11.—DETAILS OF BELL COMPLETE; A, ARMATURE; B, HAMMER LEVER; C, ARMATURE SPRING; D, PLATINUM POINT; E, SUPPORT OR ANGLE FOR ARMATURE, CAN BE MOVED, AS SHOWN BY ARROW-HEADS, WHEN REGULATING; F, MOVABLE ANGLE FOR ADVANCING OR RETIRING ARMATURE MOVEMENT SHOWN BY ARROW-HEADS; G, PLATINUM POINT; H, MAGNET WITH COILS ATTACHED; I, CROSS-WOOD PIECE TO HOLD COILS IN POSITION, SHOWING SCREW-HEAD FIXING SAME TO BASE; J, END OF COIL FROM MAGNET ATTACHED TO MOVABLE ANGLE, F; K, BELL; L, SCREW ATTACHING BELL TO WOODEN BASE; M, EYELET FOR HANGING BELL (THIS IS OFTEN PLACED AT THE OTHER END, THE BELL HANGING DOWN); N, HAMMER-HEAD; O, POSITION OF WOODEN BOX PROTECTING BELL; P, WIRES CONNECTING COILS AND ARMATURE SPRING WITH TERMINALS, P, CARRIED ON THE UNDERSIDE OF BELL BASE-BOARD; Q, TERMINALS FOR CONNECTING WITH BATTERY; R, WOODEN BASE-BOARD. FIG. 12.—ORDINARY TERMINAL. FIG. 13.—EASILY CONSTRUCTED TERMINAL; A A, BRASS PLATE WITH SCREW FOR ATTACHING TO BASE-BOARD; P, WIRE FROM COILS AS MARKED IN FIG. 11; C, WIRE TO BATTERY HELD IN CONTACT WHEN A A IS SCREWED DOWN.



It is usual and preferable to make a box to fit over the top, for prevention of dust and particles of matter interfering with the working of the bell. An easy way of arriving at the same result, is to mark with a black-lead pencil the position the magnet and the supports occupy, take off all the fittings, and fasten four pieces of wood for sides, with screws, from the underside, just high enough for them to clear the magnet and fittings, a hole being made, if necessary, for the curve of the magnet to pass outside, if this is not considered unsightly, and another hole being made for the hammer rod to work in. If the edges are glued together and nicely rounded, the joinings will not be noticeable. Make a square piece to put on the top, and screw it on with two brass-headed screws to the sides.

Sandpaper and varnish or French polish will complete the woodwork.

The cost of such a bell is very small, the wire, the piece of platinum, and the bell being the only articles of expense. The last of these can be procured at any ironmonger's for 3d. each, being bright and gold-lacquered. The wire, being bought in such a small quantity, is dearer than when bought in the pound. The whole thing should cost about 1s. 6d.

Of course, this bell cannot be expected to have the advantages of the more expensive class; one defect, for instance, being that the wood is liable to expand and contract with the changes of the weather. This has a tendency to alter the regulation of the instrument, and so interfere with the ringing. However, if the temperature of the place in which the bell is fixed is even and dry, it will act well. At the same time the reader must remember to use well-seasoned wood, and he can screw two or three bands of iron,  $\frac{1}{8}$  inch thick, across the *back* of the base or inside, but he must take care, if he put them inside, he does not allow them to form a connection between the coils, armature, or other working parts; otherwise the bell will be "short circuited," and will not ring.

This bell can be easily constructed by anyone with only the ordinary tools found in most houses, without any scientific knowledge, and at a cost only equal to what the majority of men spend on trifling gratifications almost daily.

In the better finished bells the framework is of iron. The magnets are fastened to this, as also the armature, thus preventing expansion or contraction. Several firms sell the different parts of the electric bell separately; so the reader, if he prefer, can buy a frame ready-made. He will certainly need a more extensive assortment of tools to finish the bell than he would require for the bell mentioned in this article, among which a screw-plate and drill will be required.

In a subsequent article instructions will be given for constructing the more finished and superior class of bell, in which will be found tables which it is confidently expected will be of great service to the amateur, and which have not previously been published, at any rate, in so extensive a form.

In these latter articles the reader will find all particulars and measurements he can possibly require.

## THE RABBIT PLANE, AND HOW TO USE IT.

By DAVID DENNING.

HE possession of a tool and knowledge how to use it are two different matters, as many a one who has bought some appliance without knowing how to work it has often found to his annoyance and disappointment. Perhaps he has been told by some friend that a specially devised tool for some particular operation is what he should get, or possibly he has read a notice of the thing which seems just what he wants. Whatever the inducement, he gets the tool, and fancies he can manipulate it with all the skill of an experienced worker with little or no preliminary practice. Possibly he has never even seen one of the things in use, but sets to work with some idea of what should be done evolved from his inner consciousness. Is it any wonder if the result is at best only a partial success, or that the tool is apt to be regarded as one whose usefulness has been much overrated? Good tools are undoubtedly a convenience, if not a necessity, to any worker, but they are of comparatively little benefit unless they are properly

used. In a practical workshop there is seldom any difficulty, even with beginners, for the older hands will always give the hints required; but too often the amateur has no such opportunity of getting information. Undoubtedly the best way to learn the use of any tool, or how to do any particular operation, is to watch a skilled worker, and copy his mode of working as closely as possible. When this cannot be done, the learner must perforce either have recourse to his own ingenuity, or rely on some friendly verbal explanation.

This explanation it is the intention to give now with regard to the rabbit plane, a homely and common enough tool, but one of which not every amateur knows the proper use. It is useless to describe the many mistakes which may be made, and the mishaps which will occur when the plane is not rightly employed. The novice can find them out for himself if he is anxious to do so. At present I want to tell him what will be of more service to him, viz., how to hold and work the rabbit plane to the best advantage and in the easiest manner. It may safely be taken for granted that most readers know the meaning of the word rabbit, or, as it is sometimes written, rebate, when applied to woodwork; but for the benefit of the few novices who do not, it may be briefly explained as being a recess cut in the edge of a piece of wood. A common instance may be found in a frame. The recess within which the panel or picture lies is the rabbit. It must not, however, be assumed that a rabbit is used

only in frame work; but enough has been said to show what it is, and we may now proceed to see how it is formed.

The tool used is the rabbit plane; for we may leave out of consideration the various make-shifts, on the one hand, and the more complicated and costly contrivances of fillisters, on the other.

Figs. 1 and 2 will enable those who have not seen an ordinary rabbit plane to understand its general formation. Fig. 1 gives the side elevation, and Fig. 2 the end. Essentially, the tool consists of a block of wood about  $9\frac{1}{2}$  inches long by  $3\frac{1}{2}$  inches wide, and of a thickness the same as the width of the cutting-iron. For the sake of appearance and comfort in holding, the upper edges may be slightly bevelled and rounded. The iron, which it will be noted, is a single one, runs through at an angle of about 45 degrees. It is fastened in by a wooden wedge slightly thicker than the width of its upper part, or tang. The lower part of the iron is similar to an ordinary chisel, but very

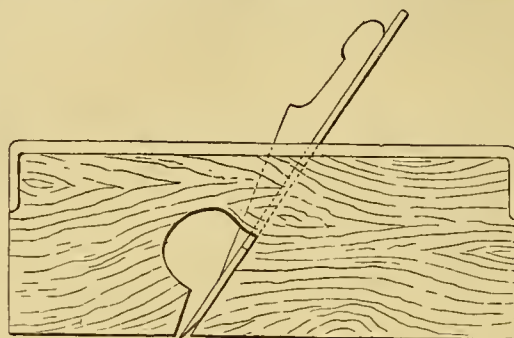


FIG. 1. Side of Plane



FIG. 3. Bottom of Plane



FIG. 6



FIG. 2

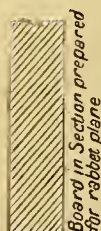


FIG. 7

much shorter. Now, referring to the sole or bottom of the plane, which is shown in Fig. 3, it will be seen that there is not, as in the ordinary planes of the smoothing kind, any wood on each side of the cutting edge, so that when planing it will be observed that a shaving of the full width of the sole can be taken. This in itself is not essential, but the peculiar construction allows of the iron cutting into the inner angle of the rabbit cleanly and sharply.

As rabbit planes, like all other tools, vary slightly in detail, it may be well to mention

that the iron, instead of being placed straight across the sole, is often placed in a slanting direction on the skew. Some workers prefer them one way, and some the other, but, except in skilled hands, the advantages or the reverse peculiar to each form would probably not be appreciated. It may, however, be interesting to mention the chief points of difference in working. The "skew" mouth is of advantage when cutting on end grain of wood, but finer finish in ordinary circumstances may be said to be got with the straight form as stated, though the difference is very slight. In order to give the necessary clearance of the shavings, the mouth widens upwards, and terminates in an opening above. In connection with the mouth, the principal point to be observed is that the closer the cutting edge is to the wood in front of it, the finer the shavings will be. To have the mouth too close is, however, not advisable, as the shavings would be so thin that the operation of rabbeting would require prolonged time. If too wide, on the contrary, the wood being worked on would be torn rather than shaved off. To explain more fully what is meant, Figs. 4 and 5 show as nearly as possible in full size a generally useful mouth and a wide one, respectively. I am rather particular in directing attention to the mouth, as it will be seen that there is really no great difficulty in any "handy" man making his own rabbit plane, and its serviceableness just depends on this and other details, which will be so obvious to those who have "nous" enough to form their own tools, that special allusion to them is unnecessary. Irons, of various widths can be bought at any tool shop; but in a subsequent article I hope to show how amateurs may make a very serviceable rabbit plane in which an ordinary chisel will be used instead of the regular iron.

At the same time I shall give more details connected with the actual making of a precisely similar plane to that now illustrated, for the benefit of those who do not quite clearly see how to construct it. Therefore, those who are interested will do well to keep the issue in which this appears. At present, having given fairly full directions about the plane itself, the way to use it must be the chief concern.

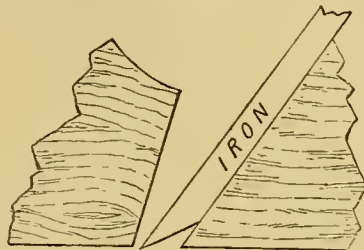


FIG. 4.—MOUTH, ORDINARY.

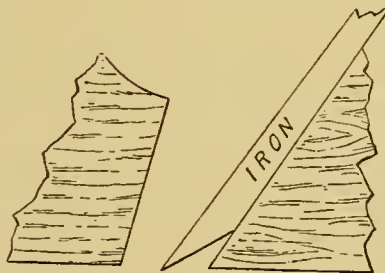


FIG. 5.—MOUTH, TOO WIDE.

For the sake of illustration, it may be assumed that a rabbit has to be cut along the edge of a piece of board represented in section at Fig. 6, where the heavily-shaded portion shows the wood to be cut away. It must be said that during the planing it is necessary to have the wood firmly held, either in the bench screw, which for general purposes is the most convenient, or secured to the bench top by hold-fast, hand-screw, or other means. From Fig. 6 it will at once be seen that the board is supposed to be fastened in the bench screw, but by whatever means it is held, the rabbetting is performed in exactly the same way. The dimensions of the rabbit having been marked with the gauge, the cutting gauge by preference, the rabbit should be started by the learner with a chisel, care being taken not to cut beyond the gauged line; with ordinary caution a mishap is not likely to occur. We may now suppose the section of the wood to be as shown in Fig. 7. The cut made with the tooth of the gauge is indicated, and the slight bevel towards it represents the wood removed by the chisel. If preferred, the whole width may be chiselled away, but it is not necessary, as all that is required is a line, or rather a projection, against which the side of the plane may work. It should here be noted that many workmen do not use the chisel, but proceed at once with the plane after marking. The



amateur, however, should hardly venture to do so till he has acquired some facility in running the plane, as the slightly sunk rabbet in which he commences planing will be of the greatest assistance to him till the plane has formed its own channel. If, now, the plane be held as follows, very little difficulty will be found in making a cleanly-cut rabbet:—The board being in the position shown, viz., with the edge to be rabbetted out on the left-hand side, grasp the plane in front of the iron with the left hand, of which the thumb should be on top, and the ends of the fingers just so far under the lower edge that as the plane is moved forward they form a guide or fence, and do not allow the cut to become irregular in width. The right hand of course holds the plane in the usual or any convenient way. Planing is continued till the rabbet is cut down to the other gauged line. While planing, the right hand side of the tool, as well as the sole, must be kept in close contact with the wood. Notwithstanding all precautions, it will probably be found that it is necessary to take a shaving or two off what, to prevent any mistake, may be described as the upright side of the rabbet. This can easily be done by just laying the plane, as it were, on its side, so that the sole runs where the right-hand side did. Although, to be strictly accurate, the iron at the side should be quite flush with the plane, in practice it is usually considered best to let it project slightly—very slightly indeed. If the iron and the wood are perfectly flush, they may be allowed to remain so, but to make sure that the iron is not set within, a slight tap, just to make “assurance doubly sure,” on the other side of the iron is advisable. It should also be noted that many good workers invariably use the plane with the iron projecting unmissably.

It is, perhaps, superfluous to say that the cutting edge must be kept perfectly sharpened, and that the right bevel must be maintained. To give particulars of cutting angles is, however, not the object of the present paper, which, if it has enabled those who were unfamiliar with the rabbet plane to avail themselves of this useful tool, has attained its purpose.

## THREE OTTOMANS, AND HOW THEY CAN BE MADE.

By J. L. DWYER, B.A.



THE heading of this article is “three ottomans,” but I might extend that number indefinitely if I was satisfied with the ottomans so extensively in use at the present day, a recipe for the manufacture of which would be something as follows: Take a box that you can sit on, stuff the top with hay, cover the whole with cretonne, and put it into your best room. This primitive style was not quite to my taste, so I endeavoured to improve upon it, without departing much from simplicity and ease of manufacture.

Fig. 1 is as near a representation as I can give of what I will take as my first model. It departs very little from the box pure and simple, but is by no means uncomfortable, although not very elaborately padded, and when artistically draped in art muslin is not unworthy of a very pretty room in this neighbourhood.

The main part consists of a structure 4 feet by 3 feet, and about 10½ inches high. Castors are put at the corners under, and the top is boarded. Wooden ends for the pillow 9" wide and 10" high are cut to the shape shown, and fastened to the middle of the long sides. That is the entire amount of carpentry work, and the stuffing is not difficult. The pillow is apparently supported with webbing placed between the ends, but it may be solid hay.

I was much struck with the appearance and simplicity of this piece of furniture, and determined to make one for my own house; but on mature consideration I concluded that such an effort was unworthy of a man of my amateur skill, and with the aid of a board and a piece of pencil I designed that shown at Fig. 2.

Many readers, however, may not care to follow me in the manufacture of this, and it is for their benefit that I have drawn and explained Fig. 1. It must be understood that the dimensions are only roughly approximate, as I took them by spanning one day when my hostess's back was turned, but they cannot be far out. I may again repeat that any person who makes it will

not be at all disappointed in the result, and it takes up a good space, if to fill a room be the object.

Fig. 2, it will be seen, differs only in detail.

Six short legs take the place of the broad boards for the sides, the seat being supported by slips only  $4\frac{1}{2}$  inches wide. Instead of the pillow, there is a railing nicely padded and buttoned on top, and this railing is continued at two ends so as to be Z shape.

Now to come to details of construction.

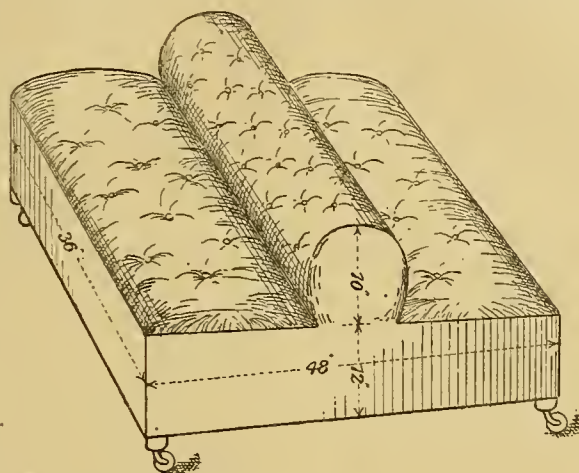


FIG. 1.

The slips, A A, all round are  $4\frac{1}{2}$  inches wide,  $1\frac{1}{4}$  inches thick, 3 feet long, and dovetailed together at the corners. The legs are all turned out of stuff 3 inches square. There are four long ones extending from the castors up to the top of the rail, and two short ones extending only to the seat. Fig. 3 is a faithful drawing of a long one, the short ones being exactly like the lower part.

It would be an improvement if the upper half were made somewhat thinner than represented in

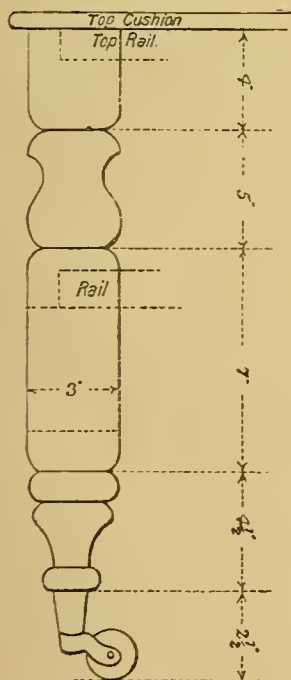


FIG. 3.

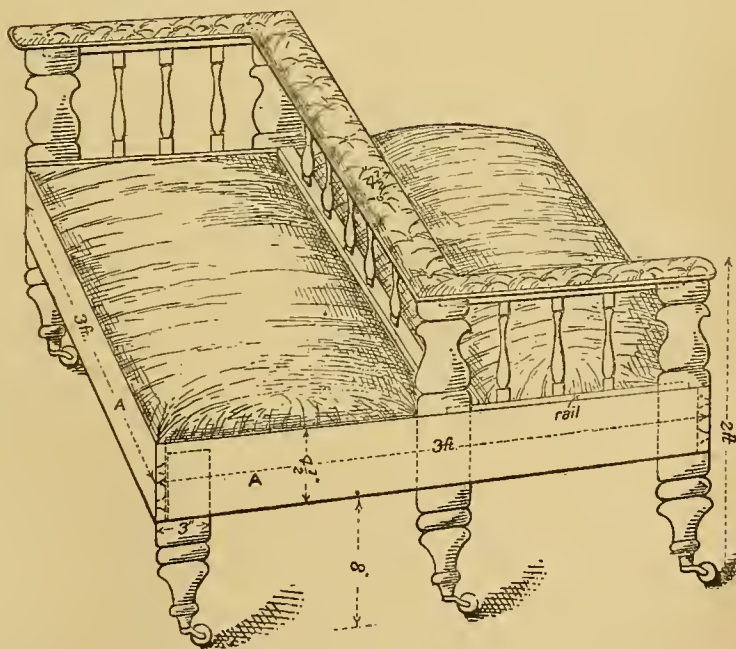


FIG. 2.

Mine is all made of deal, painted black and ebonized in a sort of way; but the work would be worthy of better material, say mahogany or walnut for the legs and rails, which are almost the only parts seen.

Fig. 3, and the square part on top could, with advantage, be reduced to 2 inches square.

When the legs are all turned they should be mortised for the rails represented by dotted lines in Fig. 3. These rails may be an inch and

a-half square. It will be seen that two of the long legs are joined together with a pair of rails running across the ottoman, and that a number of pilasters are introduced at equal distances between. The long rails would be  $2\frac{1}{2}$  feet long, shoulder to shoulder, besides a tenon a couple of inches long at the end of each. The upper one will have its upper surface flush with the tops of the legs, and the lower will be placed so that a clear space of 7 inches intervenes between both.

The short rails are  $13\frac{1}{2}$  inches, shoulder to shoulder, and have tenons, which are cut to fit mortises in the four long legs. Seven inches intervenes between them, as between the long ones. If the parts are now put together, it will be found that the four legs and their connecting rails form a Z, and they should be marked for the slips, A A, while still together. These fit into recesses sawn out of the legs in such a way as to be flush with their surface. One pair of long legs will have recesses cut out of one side, and the other pair out of two sides, the short legs being cut on two sides. The pilasters should now be turned either to the pattern shown in Fig. 2, or, what they might well be, much prettier. They are 7 inches long, and have a tenon  $\frac{1}{2}$  inch long, and the same thickness turned at each end. In my ottoman there are thirteen pilasters—seven in the long rail, and three in each short one.

The rails, legs, and pilasters may now be glued together, and the pieces, A A, fitted all round to the legs, and to each other at the corners. I fastened them to the legs with small bolts, which make them very firm indeed. At each corner there are two bolts, which add a good deal to the strength of the dovetail. The heads of the bolts should be sunk, so as not to project beyond the surface of the wood.

When the glue is dry the entire structure should be cleaned off with plane and sandpaper, and the pieces which support the top cushions, or elbow rests, nailed down to the top rails and legs. These are  $4\frac{1}{2}$  inches wide, 1 inch thick, and project an inch beyond the ends of the legs. The three pieces will be required to be mitred at the corners.

The painting may now be done, and, as I said,

I painted mine black, giving numerous coats, and rubbing each smooth with fine sandpaper. A good coat of varnish gave a bright finish.

The upholstering will be a difficult undertaking to some, but I think I had better leave this to the ingenuity of those who read the excellent articles on "Upholstery at Home," which have already appeared in *AMATEUR WORK*. It would be worth while to put springs in the seat, and to use curled hair liberally, both for it and the arm rests. Imperial plush, which I got from Oetzmann & Co., Hampstead Road, London, at 2s. 11d. a yard, is a very cheap and suitable material with which to cover any of these ottomans.

I now pass on to the third ottoman, which, indeed, partakes more of the nature of a settee. It was designed to fill a large deep recess in my dining-room.

It is 6 feet long and 27 inches wide. A leg like Fig. 3 stands at each of the four corners, and they are connected together at the back and ends with railings similar to those seen in Fig. 2.

Four pilasters are in each end railing, and fifteen in the back. Pieces corresponding to A A (Fig. 2) are attached to the legs with bolts as before, and support the seat. In this case the legs, rails, and pilasters are oak, and polished.

I trust that any of my readers who wish to make a really imposing piece of furniture with little trouble will attempt some of these ottomans. They will find the results, I am sure, to come up to their expectations.

GRAPHITE would seem to fulfil all requirements for an ideal roof paint. It stands extremes of heat and cold equally well. It is very light, one pound of graphite being three times the bulk of white lead, and twice the bulk of mineral paints; hence in use it will cover at least twice the surface. Each particle of graphite is in the form of a flake, and, in painting, these flakes lap one on the other, making a flexible coating that will stand any amount of bending. Graphite is one of the forms of carbon. As it is unaffected by contact with any known substance, it suffers no chemical change, but remains always the same.



## WOODWORKERS' BENCH:

SHOWING HOW TO MAKE IT AND  
HOW TO UTILISE IT TO THE BEST  
ADVANTAGE.

By ARTHUR J. SCOTT.



TAKE it for granted that any amateur reading this article can use a saw, chisel, and plane moderately well; if not, the bench may be put together in the rough wood, reserving for a future occasion the planing and the appendages connected with it. Of course it would be no harm, before commencing to make the bench, to prepare a drawing to a large scale from the designs given; but if care be used in measuring from the scale given, no such enlargement would be required.

The advantages to be derived from a good work bench need not be enumerated here. It is an old saying that a good workman can work with bad tools; but how much better and quicker would the same man work with good ones! So I will leave this part of the question to your imagination, and will now pass on to the making of a bench practically.

The views given of the bench are three, viz., front elevation, plan, and side elevation in part section, all drawn to scale. These dimensions are not expected to be strictly adhered to, as they may be altered to suit the amateur's own requirements, or in using up any material he may have by him, thereby cutting his slice according to his loaf. The size given, viz., 6 feet by 2 feet 8 inches, I have found to be a handy size for all ordinary purposes, so in my description I will avoid giving dimensions as much as possible, simply stating what is, in my opinion, the simplest and easiest method to be adopted during construction. I might just state here that the letters in all the Figs. referring to certain parts are the same, only showing different views.

Perhaps one of the most important requisites of a good bench is the frame. This we will consider first. I believe the best and cheapest wood you could procure, suitable for the purpose, would be good dry spruce, the legs,

according to the design given, being 4 inches by 2; the length will vary according to the height of the worker. The one given is a handy height, viz., 2 feet 8 inches; if this dimension is followed, you would want five pieces 2 feet 5 inches long, 3 inches being allowed for the bench top, so that you would require at the least a 12 feet length. To tie the legs together into a solid frame, yet to be a frame requiring no great skill or time in construction, I should recommend the corners to be dovetailed, as shown at s in Fig. 1; by adopting this method you tie the whole fabric together, both well and quickly. For additional support and strength the frame (x) should also be screwed into the legs. This frame can be made out of 1-inch timber, and the same width as the legs, viz., 4 inches. You will now have completed the four legs marked A, and the frame, B.

The top frame, c and D, we will next consider. A glance at the different views will show how the pieces, c, are securely fastened to the legs, A. The method shown is a good one, but if too much trouble, could be well secured by screws instead of bolts. The length will depend on the width you would like the recess, F. Some of ours, I believe, are against the recess, but I think the majority of woodworkers would be in favour of it. Fig. 3, being a side elevation, shows the tie pieces (c) recessed down for the top, F. This is immaterial, as it could be fastened on the tops of c, the only alteration being that the recess would not contain so deep a receptacle for placing tools. The length of c, as given, is 2 feet 3 inches, 9 inches of which is rabbetted out for the top, F, the section being the same as used for the bottom frame, B. You will next, to keep the frame perfectly rigid, fasten to it the two pieces, D and E. These two pieces are screwed to the legs of frame marked A, and in length will be 6 feet, by about 11 inches in width. The front piece, D, ought to be nicely planed and finished, as it will afterwards be used as a receptacle for the tools shown in the front elevation, Fig. 1.

Having done this, you had much better, before putting on the top, fasten in the extra leg (H) to the front pieces, D and B; also,

as an extra support, fasten by screwing the two pieces of the same section as B, shown by the dotted lines on the right-hand side of H, in Fig. 1. It will also be to your advantage to screw on the making-up block for the bench screw shown at T in Fig. 1. This will require to be about 12 inches by 6 inches, but it must be in thickness exactly  $3\frac{1}{8}$  inches, which is allowing  $\frac{3}{8}$  inch for the slide piece, and  $2\frac{3}{8}$  inches for the slide shown in Fig. 4, A and B being the slide piece, C and D being the slide. The method of construction is clearly shown in the different sections, no great dexterity being required to cut the rabbet for the slide. When you have fastened on the piece T, screw on the slide Q (Fig. 3), after which you may proceed with the top.

The top is constructed out of two pieces of 11-inch deal or spruce 3 inches in thickness, well dried

and seasoned, after which they are jointed closely together, glued, and cramped. This being done, each edge is shot straight and

square. You may now, if you wish for an extra good job, rabbet out either end, as shown

roughly in Fig. 5, and screw a batten underneath, as shown. This will help to keep the top from twisting or going out of level. Having gone thus far, screw on the top, which should just come level with the piece T, already screwed on. To fasten the bench up you will want four bolts, one of which, as shown at V, in Fig. 1, being about  $\frac{1}{2}$  inch diameter.

You will also require a plate (shown at V, Fig. 1), which catches the two pieces C C, and holds the bolt secure. You may at any future time remove the whole bench top in a few minutes. Having now fitted the top, plane it straight and level all ways, as if not so done, every piece of wood planed on it will follow the same curvature in a greater or lesser degree. This, I may make bold to say, is the most important point

connected with the bench. Having done this to our satisfaction, we may finish now the recess, F, and the tool-rack, G. The piece F is

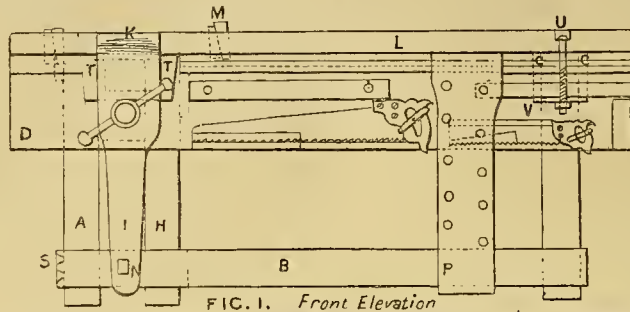


FIG. 1. Front Elevation

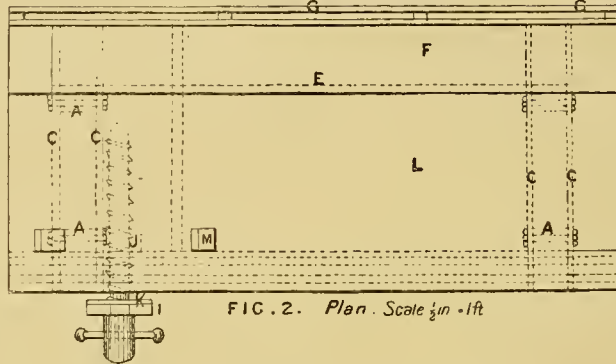
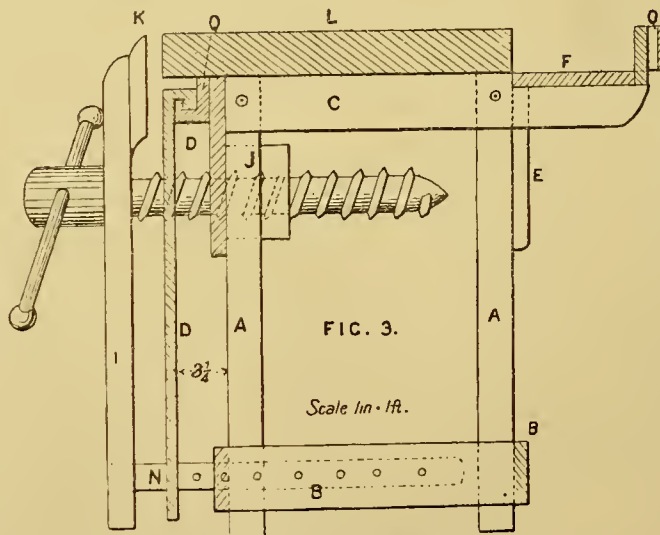
FIG. 2. Plan. Scale  $\frac{1}{2}$  in. = 1 ft.

FIG. 3.

Scale 1 in. = 1 ft.

Part Section &amp; Side Elevation.

NOTE.—SAME LETTERS DENOTE CORRESPONDING PARTS OF BENCH IN FIGS. 1, 2, 3.

merely a 6 feet length of spruce, one side of which is planed  $7\frac{1}{2}$  inches wide; this is screwed from the top, with the pieces c c, c c.

The rack (g) is also very easy of construction, being merely two lengths of spruce or pine 6 feet long, and about 3 or  $3\frac{1}{2}$  inches wide; at intervals between these are screwed four pieces, to tie them together, shown more clearly in the

pieces of hard wood, cut to such an angle that when both are put together will form a parallel block, the same section as the hole you have cut in the bench. There are several modifications of this bench stop or wedge, two of which are shown in Fig. 6, A being the same wedges, but with a slot in the centre of each containing a detached piece (c) to prevent the wedges

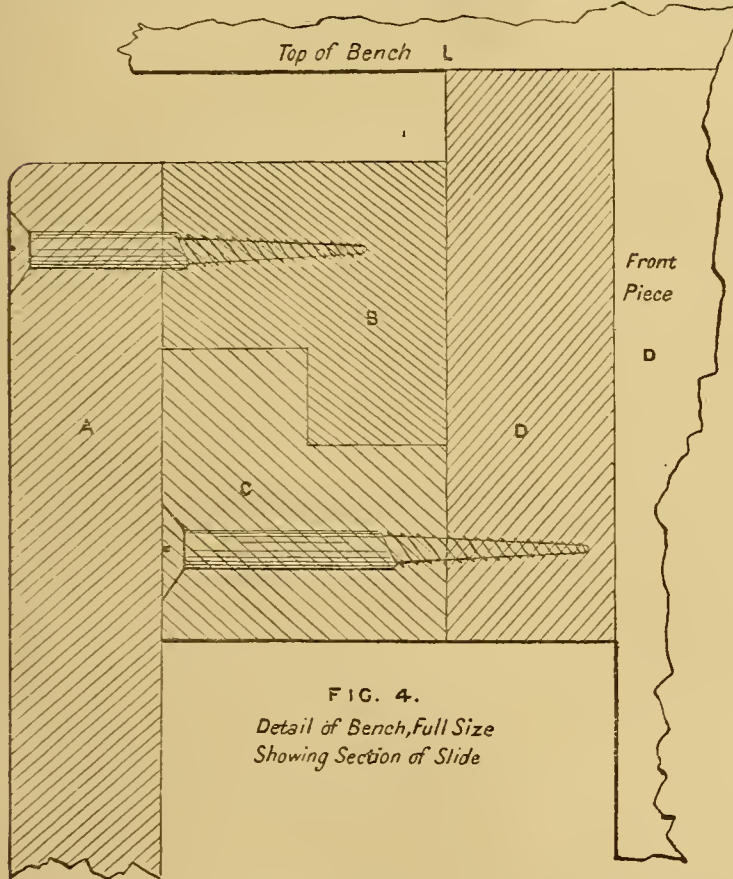


FIG. 4.  
Detail of Bench, Full Size  
Showing Section of Slide



FIG. 5.

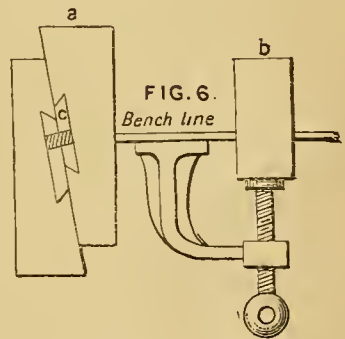


FIG. 6.  
Bench line

plan, Fig. 2. There is nothing now requiring to be done at the top, except the two wedge pieces, the making and mortising of which is shown at m. To the tyro, in the making of this bench, I may state that the hole should be cut about 3 inches square, the hole being first set out, then get a twist bit in your brace, and pierce through the bench all over as much as is possible inside the lines set out, afterwards finished with mortise or paring chisel. The wedges are easily constructed, being merely two

dropping out of hole when regulating for the thickness of stuff you require planing. At b (Fig. 6) is an arrangement which Mr. Syer supplies with his benches; perhaps our readers could get it from him. Our bench stop being finished, completes the top gear, if I may be allowed to term it, of our work bench, and the next important thing to consider is the vice, or bench screw.

Some time ago, when making our bench, we fastened on the block, t. Now in a centre line



with this block cut out a hole in *D* to clear the screw of vice. Having done so, you may now secure the nut, *J*, by screwing from the outside of *D* into the nut *J*, four screws being sufficient. The front chop, *I*, is generally cut from a piece of dry ash; if not obtainable, any moderately strong piece will do. The piece *K*, though, ought to be a dry piece of hard wood, with the grain running the opposite way to the piece *I*. Having cut the chop to shape given in Fig. 1, you may now set out and cut a hole for the screw, allowing a little clearance over the top of the threads of same; you will also need a guide-piece, *N*, about  $1\frac{1}{2}$  or 2 inches by  $\frac{3}{4}$  inch in section. This will require mortising in the piece *I*, and a slot cut in the piece *E* to receive it; when done, push the piece *N* through its slot in *E*, afterwards putting in the screw through *I* into its own nut, and screwing tight up.

The last appendage requiring to be made is the slide piece, *P*. To discuss its advantages will be useless. It only remains for me to say that it ought not to be constructed out of wood which will easily split; hard wood is much preferable. The arrangement of the saws, etc., I will leave to the amateur's own judgment. The idea set forth in Fig. 1, I have appended chiefly as a help. Of course, in this style of work bench you naturally require a longer bench screw, but this also can be obviated by fastening the nut on the front side of *D*.

In conclusion, I might say that a few drawers and tills made underneath the bench, on the right-hand side, would add much to its value.

THE PAINTING OF BRICK WALLS is mainly for the purposes of preservation, but the fact should not be forgotten that paint is an excellent preventative of dampness, and that a house with well-painted walls is dryer, and consequently healthier, than one with the walls exposed. The best paints for this purpose, where the colour is not an objection, are the natural ochre pigments, united with zinc oxide. Thus yellow ochre and zinc would give a pleasing buff. Whatever impairs the usefulness of a paint by attacking its tenacity and waterproofing quality is to be avoided.

## SPECTROSCOPES: HOW TO MAKE AND USE THEM.

By O. BECKERLEGGE.

I.—THE SPECTROSCOPE A MODERN DISCOVERY—FRAUNHOFER'S LINES—AN EXPERIMENT—CONSTRUCTIVE DETAILS.

WE have here a subject which is at once the most modern and interesting of all investigations in light, and for which the articles entitled "The Amateur Demonstrator" have prepared us. As we have seen, white light is the result, or sum total, of the various vibrations which produce red, yellow, and blue; further, that when passing from a medium of a given density into another of different density, it is bent out of its original line; and, lastly, that when a beam of light passes through a medium of varying density, such as a prism, or wedge-shaped piece of glass, or other transparent substance, some vibrations meet with greater resistance than others, and consequently are more powerfully refracted, or bent further from a straight line. Thus the light is decomposed, and the three colours or sets of vibrations overlapping each other produce the rainbow band, or seven prismatic colours. As is well known, Newton was one of the first to demonstrate the compound nature of white light. In one sense he was unfortunate in choosing a round ray of light, or light issuing from a round hole. Had he admitted light through a narrow slit instead, then spectrum analysis had not been the modern discovery it is. Wollaston, following Newton, went further, and on examining a thin slice of light, or light issuing from a narrow slit, discovered that the spectrum was not continuous, but was divided by black lines, or, in other words, there were points in the spectrum where the light did not overlap. In 1814 Fraunhofer examined light with a much narrower slit than Wollaston, viewing the spectrum with a telescope, the result being that dark lines were revealed where previously the spectrum had been supposed to be continuous. He succeeded in counting no fewer than 576 dark lines. Nothing could be more natural, than for an inquiring mind, to ask the cause of the dark lines. Was it occasioned by the substance of the

prism? But he found that whatever the prism was composed of—glass, crystal, or fluid, contained in a prismatic vessel—the lines were there, and in the same relative position. Further, he discovered that whether the light were direct sunshine or reflected from the moon or other body, the lines were persistent. There could, then, be but one conclusion: the cause was in the light itself. The position of these lines was carefully mapped out by him, and indicated by letters as A, B, C, etc., which, in honour of the philosopher, are known as Fraunhofer's lines (Fig. 1). Light from other sources was now examined, such as that emitted by burning gas, or metals raised to a state of incandescence, with the result that each kind of light gave a continuous spectrum; but the vapour of the substance gave a set of lines which, instead of being black, were of a given colour, according to the nature of the substance emitting the light. When the coloured lines in a given spectrum were measured as to their position with the black lines of the solar spectrum, they were found to coincide with some of these. Again, when light from another source was examined, a new set of lines was seen occupying another portion of the spectrum: but these, too, corresponded with certain other black lines in the solar spectrum.

The conclusion arrived at by those who have made the subject one of profound study, is that the coloured line in the one instance, and the black line in the other, proceed from the same cause, namely, the combustion of the same matter. For example, in the spectrum of the sun (Fig. 1) there is a dark line D, or when viewed with considerable dispersion it is seen to be double. Now, if when looking at the solar spectrum a sodium flame be interposed between the slit and the sun, the D line, which coincides with the yellow sodium line, becomes a deeper black. In one case the line is the result of sodium vapour; that is plain, as no other substance that we can experiment on, gives the same line. But what about the dark line in the solar spectrum—may not that be a mere coincidence? Now, the vapour of iron yields more than 450 lines; when such a spectrum is placed parallel with the solar spectrum,

every one of these lines finds a complete counterpart in the other spectrum, whether the lines are faint, thick, double, or in groups; there they are, without a fault. Other elements may be treated in the same way; the lines mapped out thus will agree with certain lines in the solar spectrum, but each substance gives quite an independent set of lines. The conclusion natural, and indeed irresistible is, that the same elements or substances have produced the lines in each case. But why is there a dark line in the one case, and a bright coloured line in the other? The following points have been demonstrated, and will help us in our investigation.

1. An incandescent body gives a continuous spectrum.

2. A glowing vapour gives a spectrum of bright lines or bands, each vapour having, between given limits of temperature and pressure, its characteristic set of bright lines or bands.

3. An incandescent solid or liquid body, shining through absorbent vapours, gives a continuous spectrum crossed by dark lines or bands; these lines or bands having the same position as the bright lines or bands belonging to the spectrum of those vapours at the same temperature and pressure.\*

The question proposed before I quoted these three propositions has to be answered by theory to some extent; but whether our theory be right or wrong, the fact stands the same. It has been suggested that the black lines only appear so by contrast with the excessive brightness of the spectrum, the colours being too feeble to assert themselves. Another theory is that the rays proceeding from the incandescent body are quenched by passing through the vapour of the same substance, and is an illustration of "interference," which we have already referred to; but with the mere theory we have little to do.

It will be thus seen that in the hands of the scientist the spectroscope becomes a most important instrument in physical investigation. Just as the polariscope reveals different conditions of structure which are invisible by ordinary light, so the spectroscope reveals the presence of such minute quantities of matter as

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\* Proctor—"The Spectroscope and its Work."

defy every other mode of analysis. For example: Take a short piece of platinum wire, and raise it to incandescence; the spectrum will be continuous; let it cool, and pass it between the finger and thumb; again raise it to a state of incandescence, and, lo! there flashes out for an instant the yellow sodium line. Yet, who by mere chemical analysis could determine the presence of such a minute quantity of salt as was rubbed off the finger and thumb? Yet, minute as it was, it was sufficient to give the

The construction of the spectroscope is not at all beyond the power of an amateur. In one of the earlier volumes of *AMATEUR WORK*, the writer described an instrument which he made for his own use. Possibly some readers, whilst interested in the subject, are not prepared to undertake the construction of such an instrument; therefore, in the remaining portion of this paper I purpose giving plain directions, with the principles of construction, so that any one with the smallest amount of skill may be

FIG. 1. *The Solar Spectrum showing position of some of the principal lines*

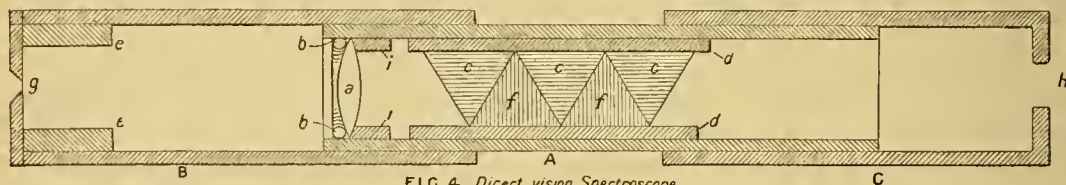
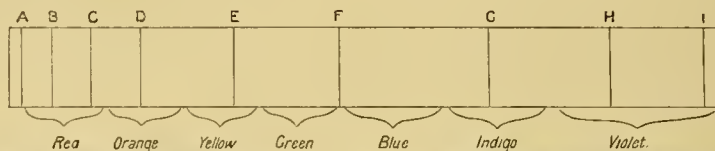


FIG. 4. *Direct vision Spectroscope.*



FIG. 2. *Prisms of different density shewing dispersion uncorrected*



FIG. 3. *Prisms of the same density shewing correction of dispersion*

#### DESCRIPTION OF FIGURES.

FIG. 1.—SOLAR SPECTRUM SHOWING POSITION OF COLOURS WITH SOME OF THE PRINCIPAL LINES. FIG. 2.—A BATTERY OF FIVE PRISMS SHOWING REFRACTION AND DISPERSION. FIG. 3.—TWO PRISMS OF EQUAL DENSITY NEUTRALISING ERRORS OF REFRACTION AND DISPERSION. FIG. 4.—SECTION OF DIRECT VISION SPECTROSCOPE; A, TUBE CARRYING LENS AND PRISMS; B, TUBE CARRYING THE FINE SLIT; C, TUBE FOR VIEWING THE SPECTRUM; a, LENS; b, RING TO RETAIN LENS IN POSITION; c, PRISM OF CROWN-GLASS; f, PRISM OF FLINT-GLASS; d, STRIPS OF CORK; e, RING OF CORK TO SUSTAIN THE JAWS; g, JAWS FORMING THE SLIT; h, EYE-HOLE FOR VIEWING.

characteristic line. It is easy to see that great advantage is given to the investigator over ordinary chemical analysis. The detection of crime is rendered easier, as blood and poisons yield evidence of their presence, no matter how small the quantities; whilst to the mere lover of knowledge the mystic ribbon of light tells of the mineral constitution of distant worlds.

I have been led to make these remarks, not only because of any historical interest they may have, but that my reader may be able to take a more intelligent interest in what I am about to say.

able to produce an instrument to demonstrate the major facts of the subject.

The essential portions of a spectroscope are: A narrow slit to give a "slice" of light; a prism to disperse or spread that slice out into a band of light; a collimator to render the rays of light parallel; and, lastly, some means of viewing the spectrum. In the construction of an elaborate instrument other appliances are added, but for our purpose those enumerated are sufficient.

First of all, then, let us understand there are two very different methods of construction.



There is the direct view method, in which all the parts are united in one tube, thus permitting the observer to direct the instrument towards the source of light. The other method involves a tube carrying the slit and collimating lens, also a second tube with object-glass and eyepiece, constituting a telescope; the defracting prism or prisms being placed between the two. In the former, three, five, or seven prisms must be employed; these are termed a battery. The prisms are composed of crown and flint glass, placed alternately, as Fig. 2, where c c c indicate crown, and f flint glass. The reason why two kinds of glass are used is because they are of different density.

Suppose A and B (Fig. 3) were both of either crown or flint glass, then their refracting and dispersing angles would be the same; consequently, as much as A bent and dispersed the ray in one direction, B would act with the same force in the opposite; the result being that the rays would be recombined, and the beam, A, would issue as white light in a line coincident with B.

By this means, it is true, we might view a point of light directly in front of the eye; but as the dispersion is corrected as well as the refraction, we obtain no spectrum.

Let us now use prisms of different density, and we shall find that their refractive powers are not the same as their dispersive powers. Taking advantage of this property, we can cause a beam of light to travel through a series of prisms, with the result that whilst the refraction is corrected, there is a certain amount of uncorrected dispersion available. Fig. 2 represents a battery of five prisms, where we see that whilst there is a certain amount of dispersion the beam B issues coincident with A. We can now use the prisms direct with the beam of light, and not obliquely.

A MORTAR that can hardly be picked to pieces is made as follows:—Mix equal parts of lime and brown sugar with water, and be sure the lime is thoroughly air-slaked. This mortar is equal to Portland cement, and is of extraordinary strength.

## NOTES ON NOVELTIES.

By THE EDITOR.



**FRETWORK CATALOGUE.**—Messrs. Harger Brothers, *Settle, Yorkshire*, send me a copy of their catalogue for the coming season. It is again enlarged, and forms a really valuable book of reference for amateur woodworkers. The first half of the catalogue is devoted to illustrations of tools, machines, and sundries of all kinds. I notice on page 33 that they supply an electric telephone set ready for fixing, and free of rent and royalty. Pages 36 and 37 will be useful and interesting to picture-frame makers, full-sized sections being given of various picture mouldings in gilt, gilt and black, and plain, flat and moulded oak and walnut. The remainder of the catalogue contains a large number of reduced illustrations of fretwork patterns, amongst which I notice, on page 55, some very effective cabinets.

*Vevers' Catalogue of Photographic Apparatus.*—Mr. C. C. Vevers, 12, *Market Street, Briggate, Leeds*, whose name is not unknown to readers of *AMATEUR WORK*, issues a very complete illustrated catalogue of apparatus, materials, and chemicals used in the art of photography, which he sends post free for the moderate price of twopence. A photograph of *Creskeld Lane, Wharfedale*, produced in photo-tint, forms an interesting frontispiece to the catalogue, which is fully illustrated throughout. Much of the apparatus has been invented by Mr. Vevers himself. Amongst other things I notice two remarkably cheap "Detective," or "Hand Cameras." One of these, known as "Vevers' Simplex Hand Camera," measures  $5\frac{1}{2} \times 3\frac{3}{4} \times 3$  inches, and takes twelve plates  $3\frac{1}{4} \times 2\frac{3}{8}$  inches, which can be exposed in rotation without recharging. It is fitted with a rectilinear lens, always in focus, and has a view-finder and shutter for time and instantaneous exposure. The price, including 1 doz. rapid plates, is 28s. 6d., complete in case. The other camera referred to is "Vevers' 24-Shot Detective Camera," which is in the form of a handsome walnut dispatch box, with strap to sling over shoulder, brass handle for carrying, etc. It carries a spool of Eastman's films, sufficient for 24 exposures, which may be exposed in quick succession without opening any part of the box. Price complete, with spool, in case, 50s.; extra spools, 3s. each. Vevers' "Magnesium Flash Pistol" is a cheap and ingenious arrangement for using the magnesium flash light for securing portraits at night, and is supplied post free for 1s. 3d.

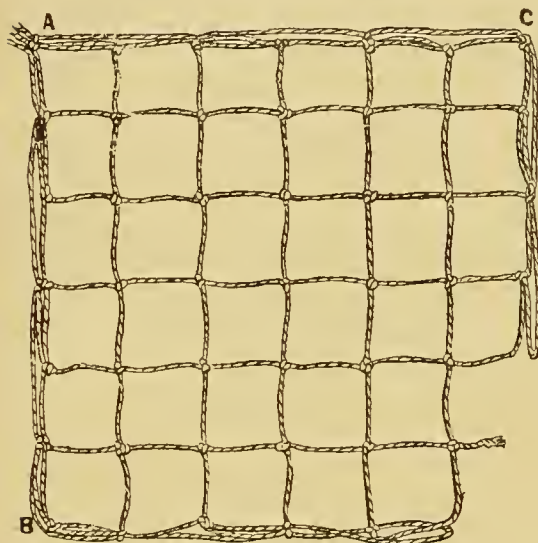
*Coaguline.*—Kay Brothers have sent me a sample of their transparent cement, which is sold in bottles at 6d., 1s., and 2s. each. Without testing this sample I can speak from experience of Kay's Coaguline, having used it for some years past with the greatest satisfaction. It sticks closer than a brother, and will repair anything but broken heads.

## AMATEURS IN COUNCIL.

For "*Instructions to Contributors and Correspondents*," see p. 46 of this Vol., or Part 13 (New Series), p. 46.

### Square Netting.

H. M. BROMLEY (*Weymouth*).—This differs from the ordinary netting only inasmuch as it is commenced at one corner, as at A, and is netted diagonally across the square, as from B to C. Begin by working two stitches; withdraw the mesh, turn the work over, and proceed as for plain netting, but increase a stitch in every row by making two



stitches on the last loop of the previous row. Continue this until you have completed half the square, that is, until you have arrived at the line B C, then do one row without increase. To form the remaining half of the square, decrease by taking two loops together at the end of every row, and so reduce until only two stitches are left on the mesh. Fasten these two stitches together by knotting the end of the twine at the top of them. For net making with twine I prefer to use the fisherman's stitch to the one described by Mr. Buchanan, as I find it quicker to work and less trying to the fingers, which soon become sore when using a hard twine. If the above description is not clear to you I will (if you will

remit two stamps to cover postage) send you a piece of square netting commenced and left on the mesh, so that you will at once see the method of working.—Ed.

### Ferro-prussiate Paper: How to Make and Use it.

JOHANNESBERG.—Dissolve 10 grains ferrocyanide of potash (also known as red prussiate of potash) in 4 ozs. water; also dissolve, separately, 15 drachms ammonia-citrate of iron in 4 ozs. water; filter the two solutions through filtering paper, and mix. Filter again into a large flat dish, and float each sheet of paper for two minutes on the surface of the liquid,

taking care that none gets on the back of the paper. Hang the paper in a dark place to dry, and if kept from light and damp it will retain its sensitiveness for a long time. To copy a drawing, procure a heavy sheet of plate glass, and lay the drawing to be copied face downwards on the glass, and lay the prepared side of the sensitive paper on the drawing; place upon it a piece of thick felt, and on the felt a flat board. Fasten

all tightly together with clips. Now expose, glass side up, to sunshine or diffused daylight. The time of exposure may vary from minutes to hours, but the progress of the colouration can be watched by leaving a piece of the sensitive paper projecting from under the glass. It is better to give too much than too little exposure, but there is a happy medium that can be best learned by experiment. After exposure, the sensitive paper is well washed in several changes of clean water. It is advantageous, after several washings with water, to pass over the wet surface a weak solution of hydrochloric acid (3 or 4 parts acid to 100 parts water), which gives brilliancy and solidity to the blue tint. This should

be followed by two or three rinsings with fresh water. The above method gives a copy in white lines on a blue ground. By copying this white line print on another sensitive sheet, blue lines on a white ground can be obtained.

A sensitive paper which gives a positive image (*i.e.*, blue lines on white ground) is made as follows: Prepare three solutions, one of 60 ozs. gum arabic in 300 ozs. water; one of 40 ozs. ammoniacal citrate of iron in 80 of water; one of 25 ozs. iron perchloride in 50 ozs. water. Allow to settle, decant, mix, and pour into a shallow dish; sensitize the paper as before, and hang up to dry. The mode of printing is exactly the same as before, but the exposure is shorter, varying from a few seconds in sunshine to 15 or 20 minutes in the shade. The exact period must be tested by exposing at the same time a slip of the sensitive paper under a piece of paper similar to that containing the original drawing, and ruled with fine lines, so that a piece can be torn off from time to time, and tested in the developing bath. If the exposure is incomplete, the paper will become blue all over; if overdone, no blue will make its appearance; if just long enough, the lines alone will be developed in blue on a white ground. During the tests the printing frame should be covered over to prevent the exposure from proceeding. When the exact point is reached, the print is floated for a few moments on a bath composed of 1 oz. of ferrocyanide of potassium to 4 ozs. of water. On lifting it off, the design will be seen in dark blue lines on a white ground. The liquid must not flow over the back of the paper. By lifting a corner the progress of development may be watched. As soon as the lines are sufficiently dark the process must be immediately arrested by placing the sheet on a bath of clean water. If a blue tint should then begin to spread over the paper, it may be immersed in a mixture of sulphuric acid—3 parts to 100 parts of water. After leaving it in this for 10 or 15 minutes the design will clear, and the sheet may be washed in clean water, using a soft brush to clear away any remaining clouds of blue; then hang up to dry. If any specks of blue are formed in the paper, they may be



removed at any time by touching them with a solution of soda or potash carbonate. Blue prints on a white ground may be changed into black by dipping the proof into a solution of 4 ozs. common potash in 100 ozs. water, and subsequently in a solution of 5 ozs. tannin in 100 ozs. water. This is fixed by washing in pure water.

#### Bookbinding Tools.

FRANK S. MORTON (*Maine, U.S.A.*) writes:—"I was very much pleased to hear of 'H. B.'s' discovery of old bookbinding tools made on the same principle as those described by me in *AMATEUR WORK*. I had never heard of any such tools before I made mine, and was glad to know that somebody else had thought of the same thing. If 'H. B.' has fancy type, as he says, he probably has a large or small printing press also; and he can make a much surer job of his lettering by printing labels with regular type hot, and in the press, and then sticking them on to the back of his book, than he can by hand printing. The Editor has a paper in hand, written by me, describing how this can be easily done; and I think 'H. B.' will find it a much more satisfactory process than printing direct on the book. I have done good lettering by both methods. If a small printing press is not handy, or if it is desired to letter direct on the book, then the electrotype should be used. A point to bear in mind is that the larger and more bulky the base of the electrotype is, the longer it will hold the heat. Of course there is danger of the solder melting, but if the copper face is good and thick this danger is much less than there is in melting regular printer's type."

#### Dynamo for House Lighting.

J. A., *Dundee*. — You could use malleable iron for the field magnets, but it must be of the best quality, and made very soft. You do not say the size of rooms, nor the number of gas-lights; but assuming the rooms to be of ordinary size, you would require three ten-candle power incandescent lamps in each, which would take a dynamo capable of developing 90 or, say, 100-candle power. If you propose making it, I would advise you

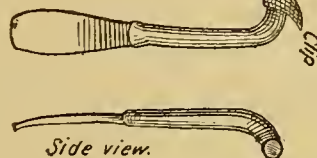
to communicate with Mr. S. Bottone

*Stanley Road, Carshalton, Surrey*, who makes a speciality of small dynamos, and who will supply you with the castings and materials, and information as to winding, etc., if you tell him the number and size of lamps you wish to use.

I do not think the ordinary house water supply will give sufficient power for driving a water motor, which should be at least quarter-horse power. Small water motors are made by Messrs. P. Pitman and Co., *Aubrey Road, Withington, Manchester*, and Mr. T. Wheeler, Engineer, *Preston*. If you write either of these, giving size of water-pipe, and pressure, they will inform you what power you can get, and the price of the motors they supply. — ELECTRON.

#### American Organ Building.

THE AUTHOR of these papers has asked me to give a full-sized illustration of the Octave Coupler Wire shown in Fig. 52, on page 388. He lays great stress upon the correct bending of this wire, and thinks that a full-sized sketch will do away with any difficulty in the matter. I have therefore complied with his request.



Side view.

OCTAVE COUPLER WIRE.—FULL SIZE.

#### The Expense of Photography.

FRANK S. MORTON (*Maine, U.S.A.*) writes:—"I think there is justice in 'Co. Cavan's' criticism of 'A Printer's' article, but the Editor states the case exactly when he intimates that the matter of expense in amateur photography lies with the person who practises it, to a great extent. 'A Printer' is all in the wrong, however, when he states that if one practises amateur photography he must let all his other hobbies go by the board. There is no reason why one cannot make a good picture one day, bind a book the next, make a camera the next, saw out a bracket, and turn out a piece of fancy work on the lathe the next, and so on, and do them all well if he chooses to, and will give attention to his work. I profess to be able to do it, and I am enthusiastic in my admiration of the art of all arts, photography. Doubtless many do drop everything else when they take it up, but it certainly is not necessary. What makes it expensive is the idea, 'you push the button and we will do the rest.' If the amateur would 'do the rest,' as well as only push the button, he would have much more satisfaction in his pictures, and much less expense. I fully endorse what 'Co. Cavan' says of expense, and I can make pictures at no more cost than what he states. I have carefully figured expense in making prints, and it is astonishing how little it costs to make pictures, counting material alone. The following figures, showing cost of material to make and finish 18 5 × 8 prints, or 36 4 × 5 prints, may be of interest. (In England the cost would probably be lower than in this country) :—

|                                                   | Cents.   |
|---------------------------------------------------|----------|
| 2 sheets albumen paper at 90                      |          |
| cents a dozen . . . . .                           | 15       |
| 2 grains chloride of gold . . . .                 | 7        |
| 30 grains nitrate of silver, at 65                |          |
| cents per oz. . . . .                             | 4        |
| 2 ozs. hypo . . . . .                             | 1        |
| Other chemicals, paste, etc. (not over) . . . . . | 3        |
|                                                   | <hr/> 30 |

This makes the cost of 5 × 8 at less than 2 cents each, and 5 × 4 at less than 1 cent. This does not include mounts, but they are very cheap. At



such moderate cost no one need be deterred from picture making, unless they do not care to do the work themselves; then the item of labour enters in, and makes a big difference in the cost."

#### Where to Buy Chucks, Bits, etc.

ENGINEER (*Brixton*) writes:—"Electricity" has had the goodness to give Mr. J. Reside's name a few times for castings, etc., and I take the liberty to also recommend him for finished goods. I have lately had a 6-inch 4-jawed dog chuck from him with independent reversible jaws at 38s.; and as this is the most useful appliance ever supplied to an amateur engineer, it should interest your readers, saving as it does about 20s. over other makers' prices. I have also had some half-round boring bits so difficult to get now at half the price quoted in a London maker's catalogue. Mr. R. is an engineer, and supplies his goods in a state that he would use them in; so the amateur can rely he gets the proper article and good. He apparently keeps no stock, but he has always executed my orders with despatch, making his goods to standard pattern. His address is Mr. J. Reside, *Engineer, Brighouse, Yorkshire*.

#### Model of Switch.

PATENT.—The switch invented by you, of which a neat little model has been sent, would form a useful part of an electric toy, and might find favour with the makers of those toys. It would only be useful where a small current (such as that used in working small electric bells, telephones, and toy telegraphs) is employed. Being made of wire, with only a small contact surface, it could not be used for heavy currents. As its use would be restricted to light work, I do not think it would be worth patenting unless a maker of electric toys would take it up. I think, however, that I have seen the idea in print somewhere.—G. E.

#### Telescope Making.

F. A. H. can scarcely have perused the article with the care essential to its successful adoption, or he would not ask "where to buy the lenses?" As, however, he lives in London, he

had better call personally on Mr. Wood, Cheapside, or other leading opticians, and state the limit in size of telescope which he wishes to carry about at the sea coast, and also the extent of outlay in the class of "object" lens. The fewer he has, the easier to construct; but better effects are, of course, obtained by a judicious combination, arranged by an optician, in the order, not only in which they follow each other, but particularly in the position of their surfaces relative to each other. There are, however, no great difficulties, and I write from practical experience. The construction of either the marine or even astronomical telescope, will well repay any little care and trouble in the work.—EXPERIENCED AMATEUR.

#### Cleaning Lamp-Burners.

PARAFFIN.—To clean your lamp-burners, take a piece of soda the size of a walnut, put it into a quart of soft water, place the lamp-burner in it—an old tomato-can is good enough—and set it on the stove; after boiling for five minutes, remove the burner, and, when put back on the lamp, it will be as good as new. All the carbon on the old burners should be removed once every month.

#### Fly-Wheels.

THE BRITANNIA CO. (*Colchester*) write—"In reply to C. J. Wolfe (page 480), we may inform him that although extra speed is such an advantage to wood turners, the momentum would be too much; he could not stop it quickly, which is very desirable. In the case of our patent saw, when the speed is at the rate of 60 or 70 treads, the momentum is such that you may stand on the treadle, and it carries you up (if twelve stone) 28 times. The lathe, prepared as C. J. Wolfe suggests, would not have such a momentum with a 30-lb. wheel; but we advise a much smaller wheel if one is used. He had better increase the size of his fly-wheel."

#### Hot-Air Engine.

W. W. W.—I hope to give some papers on the construction of small motors in the next Volume. The writer who undertook the subject, has not yet developed sufficient energy to get through with it.

#### Paper Walking Sticks.

J. H. CLYMER (*Oakdene, Villiers Road, Willesden Green, N.W.*) claims to hold a patent for the manufacture of paper walking sticks, as described on page 402, and gives the number and date of his specification as 17,417, December 19th, 1887. Professor L. Marissiaux, the author of the article, informs me that such sticks have been made in France for nearly a century.

#### Workshops at the People's Palace.

L. G. says:—"I was all over the workshops of the People's Palace a few days since. Wonderful opportunities there!" You are right; it is an admirable scheme well carried out.—ED.

#### Imitation Ebony.

STAINER.—Yes, you can use aniline for imitating ebony. The method of procedure is as follows:—First paint the wood with a one per cent. solution of sulphate of copper. When perfectly dry, the wood is painted over with a liquid consisting of equal weights of aniline hydrochloride and spirits of wine. The blue vitriol acts on the aniline and forms nigrosin, a black which cannot be affected by acids or alkalis. A lustre can be added by coating with simple copal varnish.

#### BRIEF REPLIES.

J. A. (*Dundee*).—Much obliged for your good opinion. Ask as many questions as you like; these pages are open to all comers.

H. J. WIPPELL (*Chicago*).—I have sent your letter on to "Semper Eadum." Your "trenchant" typewriter is more likely to elicit an answer than my "trenchant pen."

S. GEORGE (*Mildmay Park*).—Your request is noted. One of my staff has the matter in hand for you, and an article shall appear as soon as I can find space.

J. DICKINSON.—The address you ask for is Addis, Son, and Chidley, 6, 7, and 15, Leicester Street, W.C.

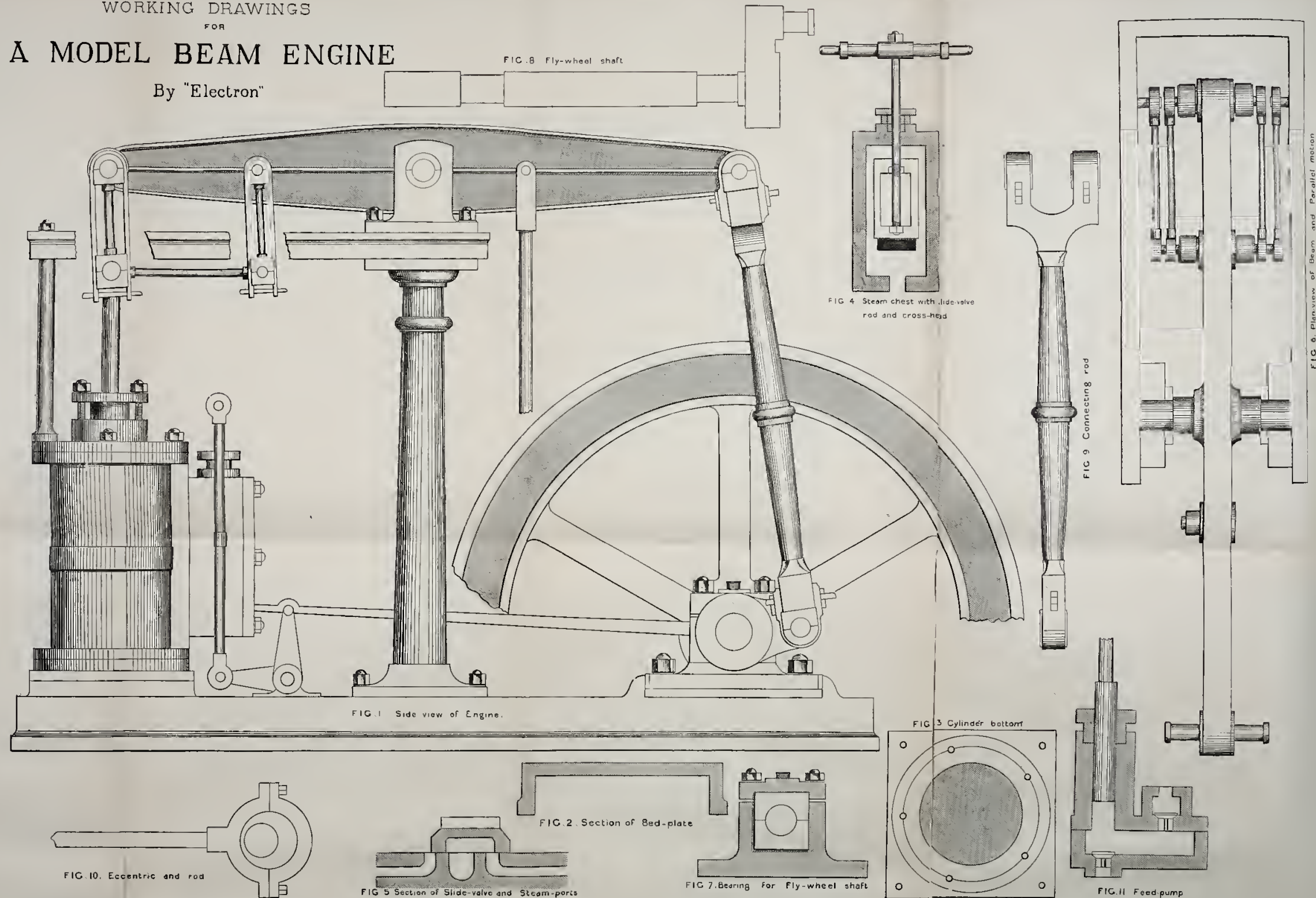
#### LETTERS RECEIVED UP TO SEPT. 12.

T. BIRTWISTLE; PATENT; TYPOGRAPHICUS; H. J. T.; C. A. PHILIPS.



# WORKING DRAWINGS FOR A MODEL BEAM ENGINE

By "Electron"







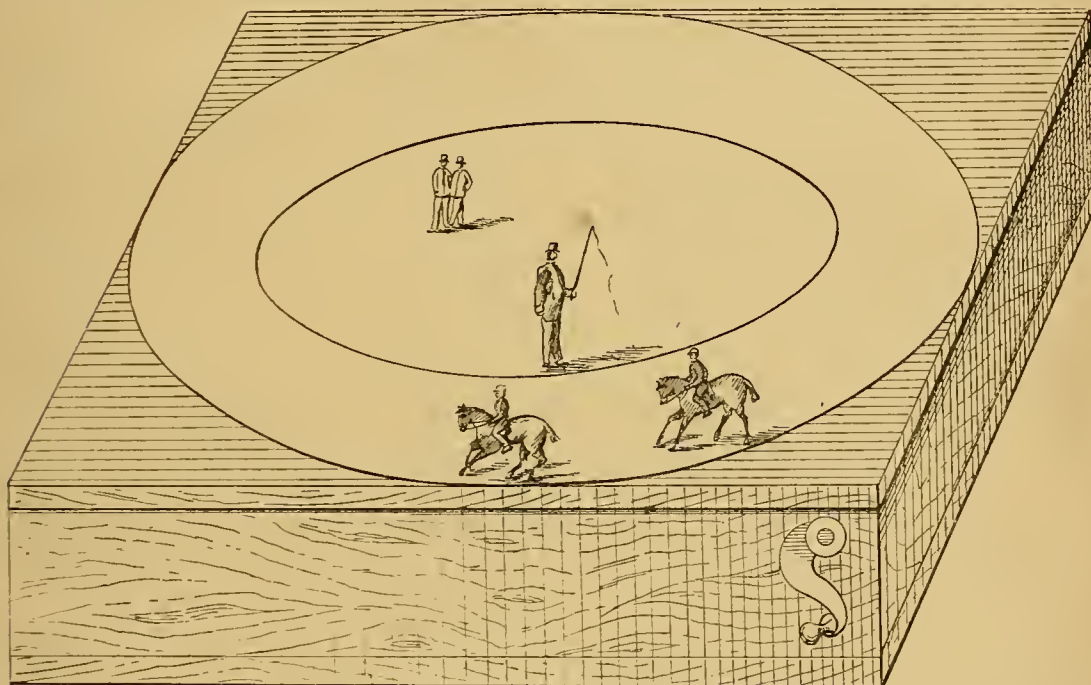
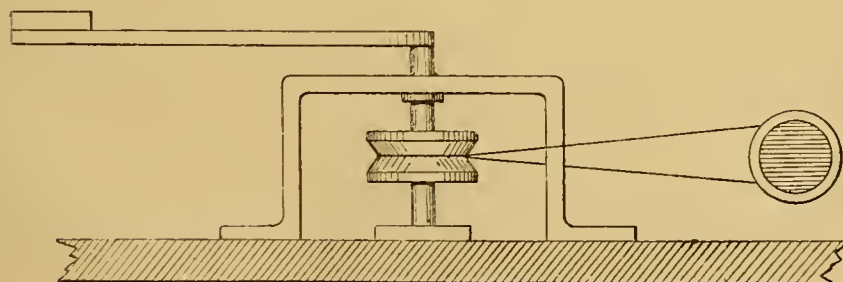


## HOW TO MAKE AN ELECTRIC CIRCUS.

By *ELECTRON*.

**T**HIS toy is constructed on the principle of the action of a magnet on pieces of soft iron, the magnet being concealed.

ing to the centre of the track on the under side, and to this arm is fixed a permanent magnet, so as to revolve round under the track, and as close to it as possible. A brass or wood pulley is keyed on the vertical axle, and an axle is also fixed across one side of box, with a handle outside. On this axle is fixed another pulley,

FIG. 1. *Electric Circus*FIG. 2. *Mechanism of Circus*

Make a wooden box 9 or 10 inches square, and  $1\frac{1}{2}$  inches deep; the top is covered with smooth thin cardboard, upon which is painted a circular track, similar to what is made in a circus, as shown in Fig. 1. In the centre of the box is fixed a vertical axle, with an arm extend-

which communicates motion to the vertical axle, by means of a small leather band, as shown in Fig. 2. On turning this handle, the vertical axle is carried round, causing the magnet to rotate round under the track. Small figures of men, horses, cars, etc., are set on the track;



these have soft iron bases, and as the magnet comes underneath them, they are carried round the track. The figures must of course be made very light, so as to be easily attracted by the magnet. Figures which are not to be carried round, are fixed on wooden bases, and when mixed among the moving figures have a very pretty effect. A small musical-box is also attached to the axle worked by the handle, either directly or by a belt, so that when the handle is turned, the effect of the band is also given.

The corners outside the track may also be filled with small figures, to represent the audience. One half of the bottom of the box should be made to take out, in order to fix the belts, and it can be fastened by screws. The top end of the vertical axle is fixed in a brass strip, bent as shown, and screwed to the bottom of box. It will also be advisable to have a shoulder on the axle, where it passes through the brass, to prevent it rising up out of its place. The lower end rests in a pivot of brass, screwed to the bottom of box.

## HOW TO MAKE A BEAM ENGINE.

By *ELECTRON*.

(For Illustrations, see folding sheet presented with this Part.)



On an amateur with a taste for mechanical work, the making of a beam engine, although entailing a considerable amount of work, will form excellent practice, and when finished it makes a very handsome model. The cylinder of the engine about to be described is  $1\frac{1}{2}$  inch bore and 2 inch stroke. It will be advisable to make a full-sized working drawing, so as to get the dimensions of each part, and it also gives a better insight into the details of the various parts.

Fig. 1 is a side view of the engine, full size; the bed-plate, cylinder, beam, fly-wheel, bearings, and beam pillar are of cast-iron, the connecting-rod is of wrought iron, the rest of the forgings are of mild steel, and all the principal bearings have brasses.

The bed-plate is of the box pattern; a section of it is shown in Fig. 2. Chipping pieces are

cast on the top for bed of cylinder, beam pillar, and bearing for fly-wheel shaft; an opening is also cast in it for the crank to work in.

Level the under side of bed-plate by filing, then lay it on a surface plate, and mark with scribing block, and file level the beds for cylinder, beam pillar, and bearing, and scribe a line down centre for fixing cylinder and beam pillar by; also drill six holes to screw it down to wood foundation.

The cylinder can be bored by bolting it to the top of slide-rest of a large lathe, and fixing a boring bar between the centres; two cuts should be taken to make the bore more accurate. It must then be fixed on a mandrel, and the flanges turned. The mandrel can be made by casting two discs of lead on a bar of iron which has been centred, and turning the lead down to fit the bore of cylinder. Then lay the cylinder on the surface plate, with the face of steam ports upwards, pack it level, and scribe and file face level. The steam and exhaust ports will be cast in the cylinder, and will only require cleaning out and squaring on the face. The cylinder bottom is shown in Fig. 3, the under side is square to fit on the bed-plate; bed the casting in a recess turned in a piece of wood screwed to face plate of lathe, and turn the top side. The circular part must be made the same size as flanges of cylinder, the centre part shaded, to project  $\frac{1}{16}$  inch into cylinder. While in the lathe, scribe a line to drill holes by, as shown; then reverse it, and turn the under side. The top cover can be chucked, and the face turned in the same manner; and while in the lathe, drill the stuffing box  $\frac{5}{8}$  inch diameter and  $\frac{1}{2}$  inch deep, and finish with a  $\frac{1}{4}$ -inch drill. Then fix a mandrel in this hole, and turn the edge and the underside, scribing a line for drilling holes to. The gland must have a  $\frac{1}{4}$ -inch hole drilled in centre; it can then be turned on a mandrel to fit stuffing-box. Drill three holes in flange, and fix to stuffing-box by three screws  $\frac{3}{32}$  inch diameter. Drill five holes in top and bottom covers for  $\frac{1}{2}$ -inch screws. The holes in flanges may be marked from those bored in covers by laying them on and marking through covers. The screws in bottom cover are countersunk headed, and are put in from the under side. The piston rod is  $\frac{1}{4}$  inch diameter,

and is made a little less at top and bottom ends, to screw into piston and cross-head. The piston is  $\frac{5}{8}$  inch thick, and has two brass rings; it is in two parts, fixed together by three countersunk screws. The rings are made thicker at one side, to give a little spring; they are turned slightly larger than the cylinder, and cut on the thin sides by a fine file in an angular direction. The cut sides are fixed opposite each other. File the steam chest level on both sides, and drill stuffing-box  $\frac{1}{8}$  inch diameter, leaving  $\frac{1}{8}$ -inch, and finishing with  $\frac{1}{8}$ -inch drill. Turn up gland, and fix by two small screws; drill hole in lower end for steam-pipe, and six holes in sides for  $\frac{1}{8}$ -inch screws for fixing it. The cover must also be faced up, and drilled for screws; the screw-holes on face of cylinder can be marked through those in steam chest, and six long screws must be made for fixing them together.

The slide valve and face of steam ports must be filed up perfectly true and level; a groove is formed in back of valve for valve rod, as shown in Fig. 4. The ends of valve rod must be reduced a little where screwed; a cross-head is fixed to top of valve rod, for working it.

A hole must be drilled into exhaust port for fixing exhaust pipe in.

A centre line must be scribed on the bottom cover of cylinder, by which it can be fixed on bed-plate by four screws. The beam pillar is cast hollow, and for turning up must have a short piece of iron driven into each end, and centred. Be careful to get the top part exactly central, or it will throw the beam to one side. Turn the top and bottom, file the edges, and fix to bed-plate by four screws; a bolt may also be put down inside, and screwed with a nut at the under side of bed-plate.

The bearings for beam are drilled  $\frac{3}{8}$  inches diameter, and have brass bushes fixed in them; these bushes are fixed by a screw from the top, the bearings are fixed to top of pillar by  $\frac{1}{8}$ -inch screws. Drill the beam for the gudgeons, or pins, and turn the pins to the lengths shown; they should be made a tight fit, and a hot bar of iron being put inside each hole, they can be driven in, and when the iron cools they will be fast, or they can be fixed by keys driven in.

It must be noted that the distance between the

two end centres of beam is slightly longer than the distance between centres of cylinder and fly-wheel shaft, viz.,  $\frac{1}{8}$  inch or  $\frac{1}{16}$  inch each way from centre.

Mark the centre of beam at each end, fix it in its bearings, making these centres square from the centre line on bed-plate, and the centre of pin over cylinder  $\frac{1}{16}$  inch further outwards than centre of cylinder. It will be better to fix the beam in position before drilling the holes for bearings in top of pillar; they can then be marked through the holes drilled in bearings. Turn cross-head for top of piston rod  $\frac{1}{2}$  inch diameter in centre part, turn recess at each side for brasses in links of parallel motion, and turn the outer end  $\frac{1}{8}$  inch diameter for the parallel bar, which is fixed by a pin and washer. The piston rod is put through the cross-head, and fixed by a nut on the top. An entablature is fixed to beam pillar, and supported by a pillar  $\frac{3}{8}$  inch diameter, screwed into cylinder cover. A bearing is fixed at each side for radius bars of parallel motion, as shown in Fig. 6. These bearings must be in line with the centres of cross-head when the piston is in the centre of cylinder.

The links for parallel motion have straps  $\frac{3}{8}$  inch wide and  $\frac{1}{8}$  inch thick, with brasses at each end. These are kept apart by a rod, as shown in Fig. 1. Two small slot holes are made at the lower end of the straps, and a gib and cotter driven in fixes the brasses, which are drilled to fit the pins in beam and cross-head. The parallel and radius bars are turned bars of steel, the ends being flattened out and  $\frac{3}{8}$  inch holes drilled in them, to connect them to the links. These are shown in Figs. 1 and 6. The lengths of the links must be made so that when the piston is in the centre of cylinder the beam is level.

Fit up the bearings of fly-wheel shaft as shown in Fig. 7. The brasses are fitted into the metal bearing; the keep, or cover, is fixed by two screws. Then drill the brasses to fit shaft, and put them on a mandrel, and turn up the outside of brasses; next file the bottom of metal bearing square from the face of brasses, and drill two holes in each to fix them to the bed-plate. A small hole is drilled in the cover and top brass

for oil, and a small brass cup can be fitted to cover. The back end bearing will require a piece of bed-plate under it, about 5 inches long; this must be made the same height as bed-plate, and the bearing screwed down to it.

Fig. 8 shows the fly-wheel shaft and crank. The shaft is made of steel, and turned with two recesses for bearings; the crank is cast-iron, bored and keyed on shaft, and a crank-pin keyed in.

Fig. 9 shows the connecting-rod. It is of wrought-iron, turned up bright; the top end has double bearings to fit on each side of beam; each bearing is fitted with brasses, straps, gibs, and cotters. These and the whole of the brasses have flanges on each side to prevent them coming out of the straps. The length between centres of bearings of connecting-rod is the distance between centre of fly-wheel shaft and pin in end of beam when beam is level or in a truly horizontal position.

The eccentric sheave is turned with a projection on the edge,  $\frac{1}{8}$  inch square, and a corresponding groove is made in the strap to fit it. If the casting have a tenon piece cast on it, it can be turned between centres in the lathe; the length of throw can then be marked, and the hole drilled to fit on fly-wheel shaft. The casting for strap is in one piece. The screws at each side must be fitted in first, then divide it with a hack saw, next screw it together by the two screws, and turn it up, making a groove in the inside to fit on sheave, with a side cutting tool made to the size. The rod is  $\frac{1}{4}$  inch wide and  $\frac{1}{8}$  inch thick, screwed into strap, and a notch formed at the other end to work the rocking shaft of slide valve. The rocking shaft is  $\frac{1}{4}$  inch diameter, and fixed to bed-plate by two small bearings. Two cranks, or levers, are keyed to it in a horizontal position, and one lever at right angles to these, with a pin, on which the eccentric rod notches. The two levers are connected by rods to the ends of the cross-head for working slide valve. The lower ends of the rods have double ends, and are fixed to the levers by screws or pins. The length of the rods must be made so that the levers are in a horizontal position when the slide valve is in the centre.

The fly-wheel must be bolted to the face-plate

of the lathe, and bored to fit the shaft, and the boss and rim turned up. A key-way must be cut in it, by which it is keyed on the shaft.

A wood base should be made to fix the engine on; it should be of a box form, 3 inches deep, to clear fly-wheel. A moulding round top and bottom will improve its appearance.

The feed pump is shown in section in Fig. 11. It is  $\frac{3}{8}$ -inch bore, and is made of brass. It is worked by a rod from the beam, and is fixed on the bed-plate. The working barrel and cover of valve box are in one piece, and can be bored and turned together; a stuffing-box and gland are formed on the top end of working barrel to receive packing; the ram is turned to fit exactly in the working barrel; the two valves are turned and ground into their seats with fine emery and water, which must be washed clean off. The top valve is fixed on cover of valve box, and a cover is fixed over it, fastened by two screws; a pipe is screwed into this cover, which is the delivery pipe; the suction pipe is screwed into the bottom of valve box. A guard must be fixed over the top of the valves, to prevent them being drawn out of their seats when the pump is working. The covers of valve box and top valve must have the joints made tight with red lead and oil, mixed to a paste; two lugs are cast on valve box, by which it is screwed to bed-plate. To find the length of the eccentric rod, turn the sheave, with its widest side away from the cylinder, and see how much the lower port in steam chest is open; then turn the sheave to the opposite side, and if the top port is open as much as the lower one, the rod is right length; if not so much open, the rod is too long; it must be adjusted till both ports are equally uncovered. It will be advisable to make a temporary rod of strong wire to get the length from. To find the proper place to key the sheave on fly-wheel shaft, put the crank into its lowest position, and turn the sheave round till the lowest port is open wide enough for a slip of writing-paper to go in; then turn the crank to the top side, and if the top port is open the same as the lower one, the sheave can be keyed on at that point. If not the same, the valve rod must be adjusted till both the ports are just opening when the crank is at the top and bottom position.



A handle can be fixed on the rocking shaft, and when the eccentric rod is disconnected, the engine can be worked by hand. Sometimes the eccentric sheave is made to move on the shaft for about two-thirds. The engine is then reversed by the handle, and it will run in either direction; to control the movement of the sheave in this case, a circular plate is fixed fast on the shaft by the side of the eccentric sheave; a slot is cut in this plate, and a pin working in the slot is screwed into the side of sheave. The slot is cut in the plate so that when the pin is against the ends of slot the sheave is in the proper position for working the engine in either direction.

Having adjusted all the various parts, make the joints of cylinder and steam chest with red lead and oil, mixed to a paste, and pack the glands with lamp-cotton soaked in oil. Screw steam and exhaust pipes into cylinder, and suction and delivery pipes into feed pump, and the engine is ready for work.

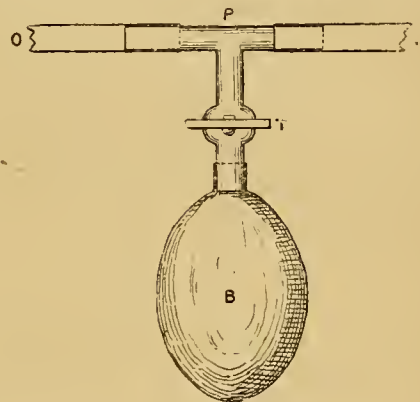
The ironwork which has not been turned or filed, and also the wood base, should be painted.

## A WRINKLE FOR LANTERN WORKERS.

By A. E. MURRAY.

**E**LL who have used a gas cylinder with a double lantern, must have found out one great drawback connected with it, and that is that during dissolving, the amount of oxygen being halved, the light is considerably reduced, and that instead of one picture dissolving into another, the first gets dim, the second then appears and gradually increases in brilliancy. Various regulators have been contrived to overcome this drawback, but they are all expensive, delicate, and, as a rule, require special adjustment. These regulators are also professedly to save turning on more oxygen during an entertainment; but the necessity for so doing is to a great extent a fallacy, for unless the bottle is very small, or nearly empty, the tap will not require touching for about a couple of hours. Now for those who, like myself, have no money to throw away, but

at the same time like to reach as near as possible to perfection, I will describe a substitute which costs only about 2s., and gives as good results as the best regulator—I think better. The whole arrangement consists in connecting with the oxygen tube a small football indiarubber bladder, as shown in the illustration. In use the tap, T, must be opened, and oxygen run into the bag, B, till it is nearly full; then the tap must be turned off, and the gas adjusted as



O, OXYGEN TUBE; P, T-PIECE OF BRASS TUBE; T, TAP; B, BAG.

usual to one lantern. The tap must then be again turned on, and in two or three minutes the pressure in the bag will equal the pressure in the tube; and it will be found that if the dissolving tap is now turned, there will be a full supply for both lanterns, and the result will be "A1," for the bag being elastic supplies extra gas at the needed pressure for some minutes. The one great thing to remember is that all alterations in the pressure of the oxygen must be made with the tap closed. Should the cylinder, as all cylinders will do now and then, cause the jet suddenly to hiss, the tap must be turned off and the pressure reduced, then either the tap may be turned on full again, and the light be expected to hiss for a minute till the pressure in the bag is also reduced; or the audience can be saved another hiss by turning the tap on again very slowly. I have often, when using the contrivance, neither touched the tap of the cylinder nor the tap of the bag once during the whole entertainment. Of course the arrangement is for the ordinary blow-through jet, not for a

mixed jet, as a back flow of gas might take place.

Have the lantern readers of *AMATEUR WORK* noticed that when a jet hisses they have to turn the gas down considerably, and then on again before they get a proper light? Perhaps they have noticed that this is necessary to cause the stream of lighted gas to jump back, as it were, to the nozzle of the oxygen tube. They will find that the best way is to turn off the gas a very little, so as slightly to reduce the hiss, and then to introduce for a moment anything—either a piece of wire, match, etc.—between the lime and the nozzle, which will cause the stream of gas to jump back to the nozzle, and the hiss will immediately cease, but the light remains bright. This plan will often stop a hiss without having to alter the pressure.

## HOW TO MAKE-UP FOR THE STAGE.

By *PROFESSOR LIONEL ARTHUR.*

V. — MAKING-UP FOR VARIOUS AGES — YOUTH — EARLY MANHOOD — MATURITY, OR MIDDLE AGE — OLD AGE.



HAVING given a general survey of the principles of making-up in the last chapter, I will now devote the present one to giving instructions in the art of altering the features and lines of the face in such a way that we may depict the various stages of manhood from early youth to old age. The various stages of a man's existence may be divided thus:—Youth, 17 to 25; early manhood, 30; maturity, 35 to 45; old age, 60; and extreme old age, 80 to 90. This arrangement I make for theatrical purposes only, and in which I take into consideration the general run of characters which seem most in favour upon the stage of the present day. Of course there are many and various styles of characters, from youth upwards; but these we will consider later on, confining ourselves at present to one type of character through the various stages of life, as indicated above. I believe I cannot do better than select for my subject the modern young man of the stage, technically known as the "walking gentleman," and taking one face, or

the same features, throughout as the standard, I will now endeavour to show as plainly as possible how to make-up the face with the necessary lines and light and shade, so that it may in each case possess the proper and truthful appearance in each of the various stages of manhood I have mentioned.

*Youth.*—In the case of a young man, very little art is required to give to the face the necessary glow of health and beauty when the actor appears upon the stage. Still, a few touches are absolutely necessary, and the eyes especially require some working up, in order to counteract the baneful effect which the glare of the footlights has upon the countenance of the actors. Unless, therefore, the eyes and cheek-bones are properly attended to, the former will have a "sunk in" appearance, and a dejected look given to the whole face. The face then, having been well washed and dried, as directed in the last chapter, the face and throat are lightly powdered with violet powder, and the surplus dusted off. All unsightly marks, such as freckles, blotches, etc., must now be hidden with some No. 1 flesh grease paint. Some rouge should now be applied well up on the cheek bones, using for this purpose the hare's-foot. In place of rouge, a slight smear of carmine grease paint may be applied. This must, however, be used sparingly, and well graduated off into the complexion, or it will look the reverse of being natural and effective. To give brilliancy to the eyes, a thin rouging should be applied immediately beneath the eyebrows, taking care to keep it quite clear of the eyelids, which should be allowed to retain the violet powder applied to them in the first instance. A faint covering of rouge, very slight, applied to the chin and ears also helps to brighten the complexion. Now take a fine camel's-hair brush, containing a little burnt umber water colour, and draw a very fine line *immediately* beneath the lower eyelashes; this gives to the eyes sparkling depth and brilliancy, and some actors throw them out still more by applying a little rouge just underneath them, letting it run into that on the cheeks. It must be clearly understood that this rouging must be very faint, otherwise the effect would be ludicrous; in

fact, it had better be under rather than over-done. Lastly, some cosmetique is applied to the eyebrows to make them fuller. This completes the make-up, with the exception of the wig, which should now be adjusted if one is to be worn. (See Fig. 49, which shows a curly flaxen wig.)

*Early Manhood.*—If the student be merely practising, the next stage of life, *i.e.*, manhood, may be worked in upon the foundation of the one just described, merely removing the rouge, if any, from beneath the eyes, and rendering that under the eyebrows somewhat fainter. If a fresh start be made, however, the face, etc., is powdered, the rouge applied to cheeks, and a tinge beneath the eyebrows, and the burnt umber lines put under the eyelashes; all as before. With the camel-hair brush some very fine burnt umber lines are run from the outer corner of each eye. Now, the direction which these lines take decide at once the character of the make-up, so great care must be exercised in putting them in. For early manhood the “crow’s-feet”—for such they are called—should be slightly indicated, unless the person be one who has seen early trouble and suffering; but the older it is intended to represent the character to be, then the more marked should these “crow’s-feet” be accordingly. But this is not all, for as I have just said, everything depends on the direction these lines take. For instance, if it is intended to represent a character of a cheerful, jolly, and buoyant nature, the “crow’s-feet” must be drawn downwards (see diagram, Fig. 50); but if the character is one of a thoughtful, morose, angry, or serious disposition, then the lines must be drawn in an upward direction, and a line running from each side of the nose also added. (See diagram, Fig. 51.) It is indeed simply wonderful the effect these lines have upon the expression of the face, and therefore great thought and care should always be given to this subject. Of course, the rules I have just laid down apply to all characters alike, and to all ages. The moustache is now fixed, and the sides of the face should receive a little blue powder, in order to give it the appearance of having been shaved. This make-up (Fig. 52)

is for a character of about 25 years of age; but if a slight amount of side whiskers are added, we immediately obtain an older appearance, say 30 to 35, according to the amount of hair put on the face. If the whiskers are used, there is of course no need for the blue powder, except a little on the most prominent part of the chin. Finally adjust the wig.

*Maturity or Middle Age.*—For characters of this class a great deal more work has to be introduced into the make-up, and, consequently, more skill and experience is necessary on the part of the artist. The colour of the skin on a man of over 30 years of age becomes more highly coloured and bronzed from continual exposure to climatic changes, and the clear, transparent complexion of youth will now have vanished. This fact must therefore be taken into consideration when making-up for middle age. The amount of colour to put upon the face, of course, depends upon the class of character; for instance, the face of the farmer or jovial countryman would be more full of health and colour than that of the city business man or family lawyer. I am not now alluding to foreigners or to the make-up for sorrow, ill-health, etc., as these subjects will be dealt with separately. In these characters a wig is nearly always worn; and if this be of the half-bald pattern, it must be put on first, so that we may match the colour on the bald part of the wig with the rest of the face. Having prepared the skin in the ordinary way, rub some joining paste on the forehead, and also some inside the front edge of the wig, brush the natural hair well back on to the head, and then put on the wig, taking care that it fits tightly and well, and entirely hides the natural hair. Now rub some joining paste on the outside edge of the wig, and also some on the forehead where the wig joins. Well rub and blend the colour with the forefinger until the joint of the wig with the forehead is almost imperceptible. The face and throat is next powdered well with fuller’s earth, and the face, neck, etc., well rouged, the colour on the forehead matching the artificial skin of the wig. The cheeks are also more highly coloured. If a full-haired wig is worn, then it is not put on until the make-up is finished, and of course for



middle-aged characters the "half-bald" is not always required. In fact, with a make-up representing a man of 40 or 45, a grey half-bald wig would be out of place. Instead of using fuller's earth and rouge, the whole face may be covered with a thin coating of deep flesh colour grease paint, well spread with the fingers. The paint, however, must be applied as thin as possible. The lines on the face will now be more

slightly, when the furrows will be at once indicated. For middle age the furrows should not be numerous, nor too marked. A curved line commencing at each nostril is drawn in the direction of the lower jaw, and terminating on a line with the mouth, and about an inch away from each corner. Short lines should also spring out from the corners of the mouth, and these must either slant up or down according



FIG. 49. Youth.



FIG. 52. Early Manhood

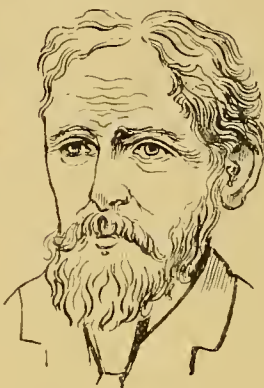


FIG. 53. Maturity.

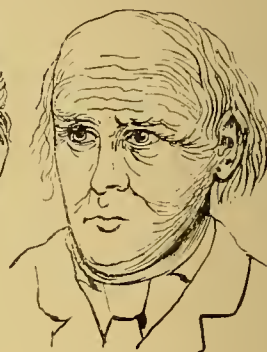


FIG. 55. Old Age



FIG. 50. Diagram showing Crow's feet drawn in a downward direction



FIG. 54. Diagram showing more distinctly the markings of old age



FIG. 51. Diagram showing Crow's feet drawn in upward direction.

marked and numerous, the "crow's-feet" running from the eyes should show up bolder, and one or two lines running from the inner corners of the eyes to the cheek-bones should be put in. With a larger camel's-hair brush slightly paint the under part of the eyebrows and the hollows of the eyes with burnt umber, or rub in a little brown grease paint sparingly. Also put in the lines under the eyelashes as before, and two short ones over the bridge of the nose between the eyebrows. The furrows on the forehead must now be put in with the brown lining pencil or grease paint. To determine where to put these lines, it is best to frown

to the disposition of the character, *i.e.*, for ill-tempered persons, downwards; for a jolly, pleasing character, upwards. A shadow must also be placed in the dimple of the chin. A little blue must be applied to the shaven portions of the face, and if no moustache is worn, the hollow under the centre of the nose is shaded with a little brown paint. If a full beard and whiskers are worn, much of the work just described is dispensed with, because a good deal of the face is then covered up with the hair. The whole of the work I have indicated must be soft and subdued in character, especially on

a small private stage, where the audience are seated very close to the actors. In a large theatre, however, some allowance must be made for the softening effects of distance; consequently, the work as a whole may be bolder, and less care exercised in the softening off process. The artist or perruquier must study all these matters beforehand, as the same make-up would hardly apply to any two places alike. Any harshness which may be apparent in the joint of the wig or the lines on the face may be considerably toned down by slightly powdering the face with some violet powder; in fact, the make-up is not, as a rule, considered complete until it has been powdered in this way. If a very young person is playing this class of character, some veins should be put in upon the back of the hands with a blue-veining pencil.

*Old Age.*—Here occurs the greatest opportunities for a display of the skill, judgment, and powers of the artist in making-up; for what can be grander than a truthful and sublime study of the effects which the ravages of time have left upon the human countenance in the shape of old age! And what an honourable and majestic appearance it gives to some men, we all must own, who have studied character even in the slightest degree; in fact, so much success can be obtained from a good make-up of this class, that it is always worth while to take one's study from the life, even if it takes some days to look for and find one. One may always find fresh fields and pastures new in this direction, for the human face is one of the most wonderful instances in nature of plastic variation of form and expression. Indeed, out of the hundreds of faces which we meet in daily life, how few do we see nearly, let alone exactly, alike! And this variation seems most noticeable in old age; therefore, an old man or an old woman's face opens a very wide range of ground for artistic treatment and patient thought on the part of the artist.

Now let us take the case of a young man who requires, for stage purposes, to transform his fresh and youthful countenance into a semblance of what would belong to a hoary-headed sire who is in his 70th or 80th year. To convey this idea of old age, the face must be invested with

a sallow hue, the cheeks hollowed, wrinkles, lines, and furrows introduced plentifully, the size of the eye decreased, and a few teeth stopped out. We will now go through all these operations separately. Prepare the face, hands, and arms in the usual way, and adjust the "bald," or "half-bald" wig, making good the joints with joining paste. If the stick of paint is too hard, which is often the case in cold weather, warm it near the gas. Now give the face a coating of grease paint to match the bald part of wig, and see that the joint is quite, or nearly, invisible. Next come the eyes. With the camel's-hair brush paint four or five lines at the outer corners—these are the crow's-feet; next, with brown grease paint, shade the eyelids and the hollows below the eyes; with the dark brown or black lining pencil, put in some lines running downwards from the inner corners of the eyes, and others running across the hollows, which have just been shaded, as shown in the diagram. Shade the bridge of the nose slightly, and draw one horizontal and three vertical lines. One or two fine lines are also drawn upon the eyelids; and a broad shadow line should proceed from the outer corner of eyes down towards the cheek-bones. The furrows should next be drawn upon the forehead with the lining pencil, the lines being continued on to the artificial skin of the wig. If this is done artistically, it will help very much to hide the junction of the wig and forehead, especially if a furrow is placed close to the joint. The temples on each side should also be slightly shaded, and one or two slight lines drawn. Two broad curved lines are now drawn, commencing well over the top of the nostrils, running down the face, as shown, and finishing off in a fine point on a level with the corners of the mouth, and about an inch from them. The nostrils may be enlarged by placing a little shadow colour on the curve of the cartilage. The nose may be also lengthened by painting a high light upon the top of the nasal bone; this will cause it to appear to spring from a spot nearer the forehead. The same effect may be produced by using Fox's "nose paste." Paint two short lines each side of the mouth, which in diagram are shown in a downward direction, for a sour,

grumpy disposition. Place a shadow or dimple in chin, and draw one or two curved lines; also shade the hollow beneath nose. Shade the outer portions of the lips with brown, to give them a withered, pinched appearance. Heighten the colour on the cheek-bones a little, and hollow out the cheeks below this with brown paint or powdered antimony. Put in three or four lines or wrinkles on each cheek, running down under the lower jaw-bone, and shade and line the neck, to give it a "shrivelled-up" appearance. The ears should also be studied a little. If no hair is worn upon the face, a little blue paint must be "blended in" with the ground colour upon the shaven portions. A pair of bushy white or grey eyebrows are now fixed over the natural ones; and also whiskers, beard, etc., if any are to be worn. In the example, however, I have shown a clean shaven face, so that the whole of the make-up may be illustrated as well as described. The hands and arms are also to be treated. Shade the skin between the knuckles and fingers, and hollow the back of hand, putting in plenty of veins with the veining pencil. If the arms are exposed, the shaded portions may be put in with water-colour, burnt umber or sepia, using a small piece of sponge for the purpose; and the veins drawn with the blue pencil. One or two front teeth are lastly "stopped out" with *email noir*, which can afterwards be easily scraped off with the nail; the teeth must be dried with a cloth before the liquid is applied. The actor should now step back a few feet, and gauge the effects of his make-up in the looking-glass; if he considers them too harsh (allowing for the softening effects of violet powder yet to be applied), the parts appearing so must be toned down, with the finger or cloth. If, however, the make-up is not bold enough, and the effects lost in the distance, then more plucky work must be put in. Finally, having brought the make-up to a satisfactory issue, the whole may be toned down into one harmonious whole by slightly dabbing the violet powder-puff over the face and throat; and the actor is ready to totter upon the stage, and try what effect his histrionic powers, aided by an artistic and clever make-up, have upon his audience. Although a make-up of this class

must be of a bold yet subdued nature, anything like smudging must be carefully avoided. All lines must be made clear of each other, if by ever so little; and they should also be so softened off, that when looked at from a distance, they appear as a shadow, and not a line. When it is desired to indicate a hollow shade, blend off the edges of the shadow colour with great care. In every make-up taken from a suitable model, whether it be real life or a picture, it is always necessary to study its lines and lights and shadows, and to reproduce them as nearly as possible, using, of course, one's own discretion as to the amount of deviation from the original.

Making-up character parts for a small stage is, I need hardly say, a most difficult operation, which requires much care and delicacy in its execution; for if the lines are at all too strongly marked, they look exactly like what they really are, namely, paint, and consequently the illusion is spoilt. The best plan for an amateur to follow, who is making himself up before a glass, is to have plenty of gas-light about the room, especially near the glass; and as the make-up proceeds, to frequently retire from the glass to the distance at which he will be placed upon the stage from the nearest portion of the audience. This will enable him in a large degree to judge whether he is producing the desired effect or not. It requires, in fact, greater care in private theatricals than upon the ordinary theatre stage, to conceal every phrase of stage trickery, so that as complete an idea of reality as is possible may be conveyed to the audience, and the success of the performance ensured, as far as regards this particular department.

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TO CLEAN OILY OR GREASY BOTTLES, pour into them a little strong sulphuric acid, after they have been allowed to drain as much as possible. The bottle is then corked, and the acid caused to flow into every portion of it for about five minutes. It is then washed with repeated rinsings of cold water. All traces of oil or grease left will be removed in a very expeditious manner, and no odour whatever will be left in the bottle after washing.



## THE DULCIMER.

BEING A DESCRIPTION OF AN OLD INSTRUMENT, AND INSTRUCTIONS HOW TO MAKE ONE, WITH MODIFICATIONS SUGGESTED.

By B. A. BAXTER.

## II.—HOW TO COPY OUR MODEL.



HAVE in the previous chapter described our old model so fully that a detailed description of every portion of the new instrument seems unnecessary; but where variation or modification has been recommended, the idea has been simplification and the addition of strength; but of all the alterations suggested, the facing of the beech ends with  $\frac{1}{8}$  inch sycamore, may be regarded as the most important. Next to this, the increase of thickness of sides and accurate fitting and glueing of the perforated cross bars: these bars, it has been said, are exactly under the turned bridges, and though the right-hand bar is not so important as to position as the more central one, it would be well to indicate, on the outside of the instrument, where these bars are placed; this could be done by inlaying a small round disc of ivory or bone.

The bar which stands under the more central division of the instrument, must be carefully placed so that the string shall be divided into parts corresponding to  $\frac{2}{3}$  and  $\frac{1}{3}$ , or, let us say, so that the same wire at the same tension produces sounds at the interval of  $\frac{1}{2}$ ; this can be secured by dividing the available space into 5 parts, and taking 3 to the right and 2 to the left, indicating the position on both long and short sides in the same proportion, and making it visible in the same manner as above.

When we fit our sound-board, we must see that it makes good contact with these bars, and having done so glue them well when fixing. In an excellent dulcimer that I saw recently, the holes which are necessary were surrounded by a turned mahogany ring of semicircular section, exactly like a cornice-pole ring cut in halves, about  $2\frac{1}{2}$  inside diameter. Having decided where the bridges will be placed, obtain two such rings, and glue them on, so as to clear the

bridges. See that the rings are in contact in every part of the flat under surface with the sound-board, or trouble will ensue. The portion of the sound-board inside the rings can then be cut away with a sharp penknife, or a fine pad-saw, to begin, and a knife or gouge to finish the edge of the cut.

The tuning-pegs used for the dulcimer may be those sold for pianoforte wrest-pins; but the amateur had better buy the smallest he can procure. There will be 66 required, and when he has the pegs, he must obtain a bit to bore the holes. It is quite unlikely that he has a bit exactly suitable; take one of the pegs to a tool warehouse, and ask for a pianoforte maker's bit, boring a hole with it, and testing the fit before purchasing. If the bit bores so that the peg fits easily, the tool dealer will readily alter it; but it is not so easy to make the bit bore a larger hole. There are, however, so many sizes of boring tools made, that very little difficulty will occur.

The hitch-pins may be either those sold for the purpose at pianoforte material warehouses, or French nails will do if the heads are cut off. The holes for both hitch-pins and tuning-pegs must be so bored that the wire will have a tendency downwards to the wood, and not from it; this can be secured by boring at a slight inclination; and to secure a neat appearance, this inclination should be as uniform as possible. Do all the boring at one innings if you can, and without change of relative position of yourself and work.

I have endeavoured to sketch the loop on the left hand of strings; this must be made short, or we shall encroach on the sounding portion of the string. Take the wire bend back about an inch, hold the bend in a pair of pliers, turn the short end of the wire round the long piece twice, then take the pliers, and hold the twist thus made; take a piece of steel, or even a French nail, and insert in loop, and twist up twice or thrice; cut off superfluous wire as short as possible, and the thing is done.

As to what wire to buy, it largely depends on the system of tuning; but I shall give two plans, and it will be optional which to adopt.

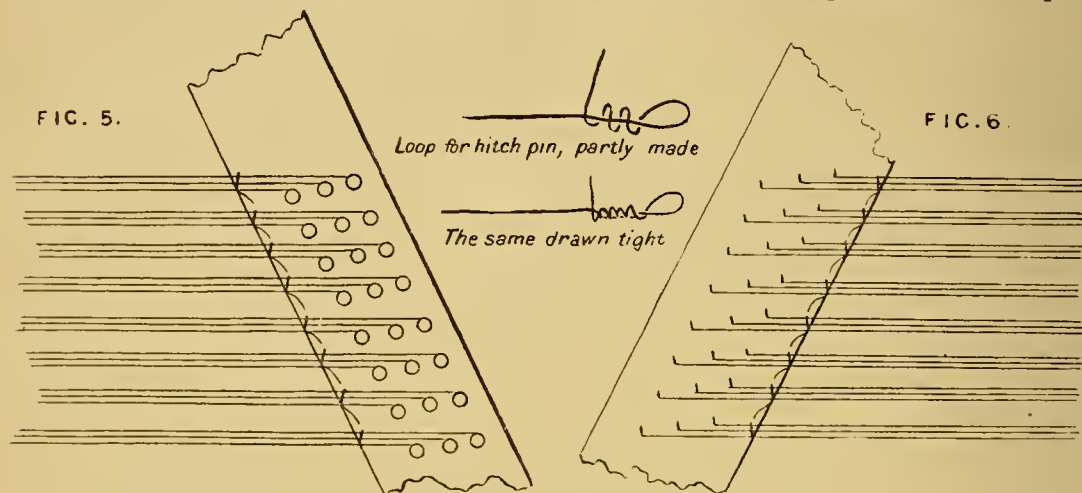
This is all preparatory to stringing or even

boring our dulcimer; but it is needful to practise these little details on waste material rather than on our work itself, and it is presumed that the readers of these papers will read the whole before taking the actual work in hand.

I find that I have omitted to advise the use of a small piece of wire on each of the turned

the upper face of each end equidistant from each other, and parallel to the edges thereof, will determine in one direction the position of tuning and hitch-pins.

This is shown in the diagrams (Figs. 5 and 6). The lines drawn to represent the strings will, at their intersections, give places for the hitch-pins;



SCHEME FOR BORING FOR TUNING-PINS.  $\frac{1}{2}$  FULL SIZE.

SCHEME FOR HITCH-PINS.  $\frac{1}{4}$  FULL SIZE.

bridges; this is of any steel wire deemed suitable, and is to prevent the sounding wires imbedding themselves in the boxwood of which the bridges are made. Any imbedding would tend to prevent the tension equalising itself, and therefore the true effect of proportional length would be lost.

We have now to finish our instrument, dividing and spacing out the places for the hitch-pins and tuning-pins. The hitch-pins may be on the line of the string, but the tuning pins must be so bored that while the string occupies its proper position, it is tangent to the pin. Perhaps it may be plainer to say that if a line is drawn representing the centre string of each group  $\frac{5}{8}$  inch apart, as before stated, that line should touch but not intersect the circle which represents the tuning-peg. Three lines drawn upon

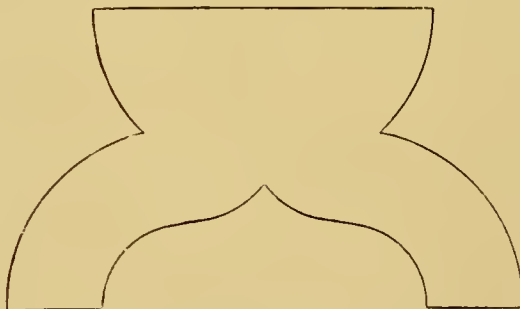


FIG. 7.—HINGED SUPPORT, MAY BE EITHER 6 IN. OR 9 IN. HIGH.

while, as already said, the centre of tuning-pins require to be their semi-diameter below the line of string. This is shown in Fig. 1.

The outer string of each group should be as near the centre string as possible, without danger of jarring or touching during vibration; but

the distance indicated in the figures sent will do very well.

We will now say a few words on the scale of the instrument. First, it is customary for the lowest note, whatever its pitch, to be called G, a custom which embarrasses the beginner. Then the plan of tuning generally excludes the chromatic semitones, which prevents music of any other keys being played. That given in the little book mentioned has the merit of great simplicity, and, if adopted, should have a stringing of steel wire about 10, 9, and 8 music wire gauge.

I should advise 10 and 9 for the long strings, and 9 and 8 for those divided, beginning, of course, with the stouter wire for the lowest notes.

With the same tension and the same length, one size larger wire produces one tone lower pitch. This is useful knowledge, and is the result of experiment made by loading various sizes of wire (2 feet between the bridges) with the same weight. If the instrument is preferred in a different key, the above information will be found of use.

The tension of the strings must not be too great, and only enough to produce a fair tone. The extra tension which is needful to raise the pitch of a stretched string through various intervals is surprising to those who have not made themselves acquainted with the facts; if to produce C needs 16 lbs., then E needs 25 lbs., G needs 36 lbs., and C' needs 64 lbs., being the square of the numbers 4, 5, 6, and 8, which is the proportional number of vibrations of those notes, the length and size of the wire remaining unaltered.

Roylance's scheme is as follows:—

|     |   |   |   |
|-----|---|---|---|
| g   | . | c |   |
| f   | . | b |   |
|     |   |   | B |
| e   | . | a |   |
|     |   |   | A |
| d   | . | g |   |
|     |   |   | G |
| * { | c | f | F |
|     | b | e | E |
|     | a | d | D |
|     | g | c | C |
|     | f | . | B |
|     |   |   | B |
| * { | e | . | A |
|     | d | . | G |
|     |   |   | G |

The right-hand column are single notes, and the two left-hand columns are those producing two notes each.

The merit of this scheme is simplicity; the drawback is that there are 9 duplicates which are certainly not needed.

\* Duplicates.

There is also a scheme which does not in every instance divide the strings unto  $\frac{2}{3}$  and  $\frac{3}{4}$ , as follows:—

|   |   |   |   |
|---|---|---|---|
| A |   | E |   |
| G | # | D |   |
| G | . | C | # |
|   |   |   | A |
| F | # | A | # |
|   |   |   | G |
| D | # | G | # |
|   |   |   | F |
| C | . | F | # |
|   |   |   | F |
| B | . | D | # |
|   |   |   | E |
| A | . | C | # |
|   |   |   | D |
| G | . | C |   |
|   |   |   | C |
| F | # | B |   |
|   |   |   | B |
| E | . | A |   |
|   |   |   | A |
| D | . | C |   |
|   |   |   | G |

This is better from a musical point of view, but it will be seen that it lacks semitones in the lower part. The wiring of this scheme would be 10, 9, 8, and 7 steel wire.

But perhaps the best of all plans for tuning would be to have twelve strings tuned to the semitonic scale for the longest strings, and nine for the upper notes, thus:—

|   |   |   |   |
|---|---|---|---|
|   |   | f | # |
|   |   | f | # |
|   |   | e |   |
| c | e |   |   |
| b | d | # |   |
|   |   | d | # |
| a | d |   |   |
|   |   | d |   |
| g | c | # |   |
|   |   | c | # |
| g | c |   |   |
|   |   | e |   |
| f | b |   |   |
|   |   | b |   |
| f | a | # |   |
|   |   | a | # |
| e | a |   |   |
|   |   | a |   |
| d | g | # |   |
|   |   | g | # |
| d | g |   |   |
|   |   | g |   |

This has only three duplicates, and it would enable any player to learn more readily than the



previous plans, the disadvantage being less compass.

Stringing had better be—for this last plan—No. 10 for all the long, undivided strings, and No. 8 for those giving two sounds each.

I ought to advise the varnishing or polishing of the sound-board. Any varnish will do, as the object is merely to exclude dirt and damp.

In boring the holes, a stop will be very helpful; it may either be a piece of wood with a hole in it, or one of the neat contrivances sold by the tool-makers for such a purpose.

The beaters for the dulcimer are best made as much like a pianoforte hammer as possible, with, however, a longer stem. If the amateur cannot obtain two old hammers from a piano, he must try to copy one as nearly as he is able.

The stand described may be dispensed with; but if it is preferred, can be made about 6 inches high, to the shape shown in Fig. 7, and hinged with a pair of brass butts.

The feet may be of wood if preferred; in any case, have the instrument well supported away from the table, as the bottom is almost equally a sound-board as the upper board.

Finally, in all the work neatness and correct fitting is required, and no glue must be spilled; what is used must be hot, thin, and fresh, and all superfluous glue should be washed off as soon as possible.

When the instrument is made and strung, take care to exclude dust by making a cover of leather cloth, or of wood, as it will prove very difficult to get out any dust that may enter at the sound holes.

A harp or grand piano tuning hammer is suitable; but buy it with the tuning pins.

**SKELETONISING LEAVES AND FLOWERS.**—The leaves are soaked in water until the cuticle loosens. It is stripped off with a brush on one side. The leaf is then turned over and the other side freed. By proper manipulation the pulp is pushed out by vertical strokes with a brush. The leaves are handled on plates of glass or on cards, on which they are floated. To reverse them, they are placed again in water and turned over. Javelle water may be used to bleach them.

## SPECTROSCOPES: HOW TO MAKE AND USE THEM.

By O. BECKERLEGGE.

II.—DETAILS OF CONSTRUCTION — LENSES — PRISMS — STAND—DEMONSTRATION—WHERE TO BUY PARTS OF APPARATUS.



ET us now proceed to construct a spectroscope, and I will take one of the simplest types I know. For this we must provide ourselves with two lengths of brass tubing. The body portion we will call A. This must be just large enough to admit the prisms, say  $\frac{3}{4}$  inch internal diameter, and 3 inches long. Four strips of cork must be glued to the sides of the prisms, as shown in Fig. 4, to make them fit the tube tightly. At the end, as shown, a convex lens (B) of  $1\frac{1}{2}$ -inch focus must be fixed, and of the same diameter as the inside of the tube. If it is a little smaller it will not matter. Make a tube of several thicknesses of brown paper and glue, to push into the tube; cut one end perfectly true; this will form a bed on which the lens will rest. If a ring of wire is now sprung into the tube, as shown, the lens will be kept in position. Take 3 inches of the other tube, which must be large enough to go over the body, and to admit of sliding without shake. At one end there must be a very fine slit.

Of slits there are two kinds, known as the adjustable and non-adjustable. The former, though more difficult to make, is by far the most useful, as for different work you need the slit adjustable. We will, however, proceed with the more simple kind first. Procure a good sound cork that will nicely fit the tube, and bore a  $\frac{3}{8}$ -inch hole through it. Take a bit of thin sheet brass, and file a disc just small enough to enter the tube. With a sharp point scratch a line across the diameter, and with a new fine-cut three-square file divide the disc nearly in two along the line. When almost through, complete the operation with a pair of strong scissors. On a fine-grained hone polish up the knife edges perfectly true; place them edge to edge, and see if they admit light at the juncture. If so, they are not true, and must be worked over

again—and again if needs be—until they meet light-tight. With liquid glue or cement fix one on the cork, with the bevelled edge outside. When the cement has set, fix the other in the same way, the edges being separated sufficiently to admit ordinary writing paper; hold it against the light to see if the slit is the same thickness at each end; if not, manipulate until it is so.

It would be an advantage to make two or three slits of different widths to use with the same instrument, as altered circumstances may require them. Another length of the same tubing (c) must be cut off about 2 inches long. One end must be closed with a disc having a central hole (E)  $\frac{1}{8}$  inch diameter. Adjust the instrument by sliding in the tube carrying the slit, also the other carrying the eye-hole. The slit and the lens must be separated by a distance equal to the focal length of the latter, whilst the eye-hole may be brought nearly close to the prism. A little practice will soon determine the precise point. Fig. 3 gives a section of the instrument, which will enable the reader to fully comprehend the subject.

As it is possible some of my readers may not care to construct a slit in such a primitive manner, I will give another mode of constructing a non-adjustable slit, and one or two methods of constructing adjustable ones.

Close the end of the tube with a disc of stout sheet brass, with a central hole  $\frac{1}{8}$  of an inch diameter. Make another disc the size of the tube, and cut it in two in the manner already described. Lay one jaw on the opening, so that the knife edge shall cross its diameter, and tack it with solder. Now place the other in its position, seeing that the edges are perfectly true; if so, they will be light-tight. Tack this also in its place. Drill a hole in each jaw through the end of the tube, take the jaws off, and slightly enlarge the holes, but tap the holes in the end of the tube. Make screw-bolts to fit the holes, replace the jaws, and secure them by the bolts—two bolts in each jaw would be better—and see if they make a light-tight joint when thus secured in their place. When they are satisfactory in this respect, take each off and rub the edge a few times with a straight even stroke on a fine hone stone, and replace. One or two trials

will result in making a fine slit, with the edges perfectly parallel.

An adjustable slit, though more difficult to make, is far more satisfactory to use; and no doubt some amateurs would prefer taking the extra trouble when the jaws are finished. Chuck the tube in a lathe, and turn down the end taper to the extent of  $\frac{1}{2}$  inch from the end; much need not be cut away, simply enough to make it taper slightly. A fine screw thread must be chased on it. Remove the tube from the lathe, and fit a plug into it, so that it shall come right up to the end. With a fine saw, such as watch-makers use, cut the tube longitudinally across its diameter. Now make a ring out of stout sheet brass, so that when the opening in the ring is chased it shall be just large enough to screw on the nose of the tube. It must now be turned up, and the edge milled. Replace the jaws, and put on the ring. It will now be seen that by screwing on the ring the jaws will be brought together, the action being the same as that employed in drill chucks and pencil-cases (Fig. 5). Probably it will be found desirable to remove the jaws, and give them another touch on the hone. Some may object to the slits in the tube as unsightly; this may be remedied by passing a tube over it, soldered to the adjusting ring, long enough to cover the slits. No disadvantage will be experienced by the stray rays of light which may enter by these, as they will not be transmitted by the prisms.

This instrument will enable the amateur to do interesting work, but of course not equal to the work that can be done by the large one I have already described in a previous Volume, and to which I refer my readers. In addition to slits I have described in this and in previous articles, I will mention one or two others. The first is one I have designed of a much less complex kind than those of the parallel ruler type, which I have no doubt other amateurs, as well as myself, have found not very easy to make. It is, however, when made with care, an excellent arrangement. This has one jaw fixed, and the other closes by a diagonal motion. Make one jaw, as A, in Fig. 6, and secure it by two small bolts. The movable jaw is shaped as B. From *a* to *b* draw a line with a

sharp point, and saw two slots, as shown. Lay it on the cap, c, with its edge close and light-tight with the other. Mark the cap through the slits, and drill holes in it. Cut two strips of brass, as d (Fig 6). These must be of such a thickness as will permit them to enter the slots

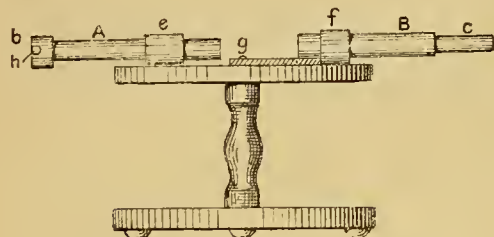


FIG. 8.—SPECTROSCOPE AND STAND.

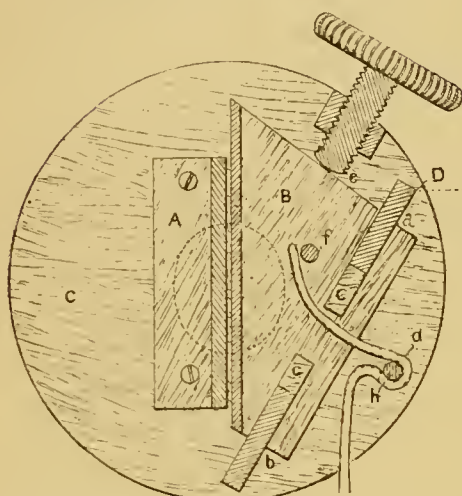


FIG. 6.—ADJUSTABLE SLIT FOR TUBE SPECTROSCOPE, ONE JAW FIXED, THE OTHER CLOSING WITH A DIAGONAL MOTION.

without shake. Make the pins in d to fit the holes in the cap (this is for strength), and solder the strips securely in their places. The slots will now allow the plate to move to and fro; which movement, carrying the jaw in a diagonal manner, will cause it to close or open. At d a spring is placed, such as is used in a mortise lock, and is called, I think, a Scotch spring. It may be purchased at any ironmonger's for 1d. The spring is placed on the pin h, with one end pressing against the pin f. At e a screw acts in opposition to the spring, which enables one to control the opening of the jaws perfectly.

I will now offer a few practical remarks on the

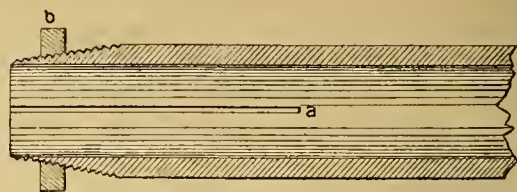
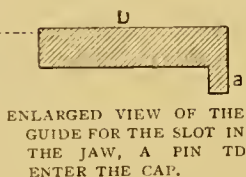


FIG. 5.—TUBE CARRYING A SLIT MADE ADJUSTABLE BY MEANS OF A RING SCREWED ON THE TAPER NOSE; a, LONGITUDINAL SLIT IN TUBE; b, RING TO SCREW ON THE TUBE TO REGULATE THE WIDTH OF SLIT.

construction of a very inexpensive instrument of the table class (Figs. 7 and 8).

**Lenses.**—Procure a pair of spectacle lens of, say, 10-inch focus. The focal length may be found by holding it opposite the sun, and measuring the distance it has to be removed from a wall to cause a small point of light or image of the sun to appear. Any other common lens would do as well, but these are more easily procured by the majority of persons. Make two tubes (A, B) of sheet-tin, or even brown paper and glue, just 1 inch shorter than the focal length of the lens. Tube A (Fig. 7), is the collimator; that is, it is to cause the rays of light to travel parallel. At one end, a, the



ENLARGED VIEW OF THE GUIDE FOR THE SLOT IN THE JAW, A PIN TO ENTER THE CAP.

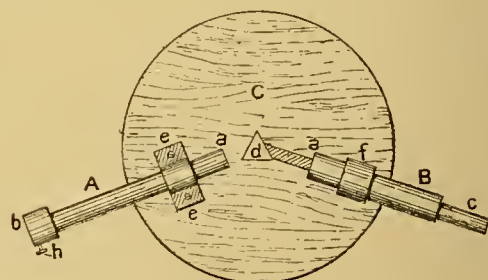


FIG. 7.—PLAN VIEW OF SPECTROSCOPE.

#### DETAILS OF FIGURES.

FIG. 5.—SECTION OF TUBE WITH ADJUSTABLE SLIT; a, LONGITUDINAL SLIT; b, RING TO SCREW ON THE TAPER END OF THE TUBE.

FIG. 6.—VIEW OF AN ADJUSTABLE SLIT FOR A TABLE SPECTROSCOPE; A, FIXED JAW; B, ADJUSTABLE JAW; C, THE CAP TO FIT THE TUBE, FIG. 7; D, GUIDE STUD FOR THE SLOT CC; e, PIN TO TAKE SPRING h; f, SCREW TO ACT AGAINST THE SPRING; g, PIN IN THE JAW AGAINST WHICH THE SPRING ACTS; g, DOTTED LINES SHOWING THE OPENING ON THE CAP.

FIGS. 7 AND 8.—THE SAME LETTERS REFER TO THE SAME PARTS; A, COLLIMATOR TUBE; B, TELESCOPE; C, TABLE; a, LENS; b, CAP WITH ADJUSTABLE SLIT; c, FOCUSING EYE-PIECE; d, PRISM; e, COLLAR TO HOLD (A) TUBE; f, COLLAR TO RECEIVE RADIAL ARM g, FIG. 8; h, MILLED HEAD SCREW TO ACT IN JAW AS e, FIG. 6.



lens is to be secured; at the other end, *b*, a tube carrying the slit is made to slide into *A*, which sliding motion will admit of adjustment.

*B* is a tube of the same length as *A*, to carry the other lens. In this a focussing tube, *c*, must be fitted to slide, carrying an eye-piece. This may either be a single lens of, say,  $1\frac{1}{2}$  inch focus and  $\frac{3}{8}$  inch diameter, or one made of a field and eye lens, as described in previous articles on spectroscopes and telescopes.

*Prisms.*—For our purpose we may use with great advantage the bi-sulphide of carbon prism already described in "The Amateur Demonstrator." But we may work even cheaper than this. Procure a "drop" pendant—a damaged one will answer our purpose; such a thing may be picked up at any second-hand shop. The one necessary point to be careful of, is to see that the pendant does not taper to one end; the angles must be parallel. With a sharp file cut a notch on the three sides, carrying it across the faces. Lay a red-hot pipe stem along the notch, which will produce a fracture. With care we shall be able to secure, perhaps, two or three prisms out of one pendant. Grind the fractured end on a slowly revolving grindstone, so that it will stand steadily.

*Stand.*—Make a disc of wood, *c* (Figs. 7 and 8), 10 or 12 inches in diameter, to be mounted on a pillar and foot, or otherwise. Of tin-plate or sheet-brass make a collar with two lugs, as *e*, to screw to the disc, or, as we will call it, the table; this will grip and hold the tube with the slit. For the telescope a collar must be made with an arm, as *f*. In the end of this arm is a hole, *g* (Fig. 8), to receive a screw. By this means the telescope can move in a radial manner so as to look at the whole of the spectrum. In the centre of the table a small platform must be raised to receive the prism *d* (Fig. 7.)

*Demonstration.*—By the means of a spirit-lamp, or even a candle, we may view the sodium line, for if the smallest imaginable portion of common salt (chloride of sodium) be placed on the wick it will give the characteristic line. Some substances, however, will require a higher temperature to raise them to a state of vapour.

For high temperature a Bunsen burner will be needed; this, with a forced draught of air, is sufficiently hot to melt platinum. The highest temperature attainable is by means of the electric current. For a small sum, Mr. Browning, the celebrated optician and spectroscopist, will supply anyone with a number of salts. I will enumerate a few which give most interesting spectra.

*Potassium.*—Gives two red lines and a violet.  
*Lithium.*—One red, and one of orange yellow.  
*Calcium.*—Bright orange, faint red, several yellow and yellowish green, one indigo.  
*Strontium.*—One strong and two faint orange lines, several yellow, and a fine blue.  
*Barium.*—Orange yellow, yellow, green, and blue.  
 All these minerals should be obtained as chlorides. The plan the writer adopts is as follows:—

Fuse the end of a piece of platinum wire two or three inches long into a piece of small glass tube; the other end of the wire is bent into a small loop. Dip the wire into hydrochloric acid, and then take up a little of the salt. Get some one to place it in the flame, as it is not always an easy matter to do this with the eye placed at the observing telescope. These experiments may be varied by viewing solutions of the various aniline dyes. In a former article in this series I described a narrow trough to use with the lantern. This may be used, the lantern supplying the light. If small quantities only of solution are available, a glass tube may be used instead of the trough. Again, light transmitted through coloured glass will yield characteristic lines.

In a former Volume the writer described the construction of a large induction coil. Various metals may be used at the terminals of the secondary coil, when the current will raise a portion of the metal to a state of vapour, each metal or mineral giving its characteristic lines.

Vacuum tubes also are exceedingly interesting to show the lines of the various gases.

One point illustrative of delicate analysis may be seen in the different spectrum of two of the salts already referred to. Strontium and lithium are both used in pyrotechnic displays

to produce a brilliant crimson colour. Now, to an ordinary observer great difficulty would be experienced in discriminating these two substances by the colour of their light; but when the light is made to pass through our prism, the bands that are, so to speak, sifted out cannot by possibility be mistaken for each other. This is a simple and beautiful experiment to demonstrate the value of this method of analysis. Frequently I receive letters asking where to procure material for the construction of such instruments as from time to time I have described.

In reply to a request made to Mr. Browning, 63, Strand, he has informed me that he will supply amateurs with any parts of apparatus which they may need. It is hardly necessary for me to add that Mr. Browning is a most distinguished maker of spectroscopic instruments; indeed, he stands at the head. Anything, therefore, which he supplies may be accepted as of the highest possible quality. A battery of five prisms, cemented together for a direct vision spectroscope, can be supplied from 15s.; single prisms, of extra dense flint of very superior quality, from 15s.; for lecture purposes, photographs of various spectrums for use with the lantern, are supplied from 2s. 6d; a set of 13 chemically pure metals, in mahogany cabinet, for spectrum experiments, for 18s. 6d. These are very valuable, and exceedingly interesting. A large number of vacuum tubes, prepared with various gases and vapours, 5s. each.

If I have omitted any little point, I shall be glad to explain, as best I can, in "Amateurs in Council."

## AMERICAN ORGAN BUILDING.

By THOS. L. WINNETT.

X.—COMPLETION OF CASE—PIPE TOP—ORNAMENTAL  
PIPES—POLISHING CASE—FINAL REMARKS.



HAVING completed the interior mechanism of our organ, it will now remain for us to consider the completion of the case. Supposing that we commence on the ornamentation of the front board, which, you will remember, we left plain in order to fix the

blow pedals. Referring to Fig. 29 (Part 18, page 257) first, a thick moulding (Fig. 86),  $1\frac{1}{4}$  inch thick and  $1\frac{3}{4}$  inch deep, must be planted on the bottom of the board, A (Fig. 29). It need not be of solid walnut throughout, a front surface of necessary thickness to allow for the beads, glued on to a foundation of white wood, will do quite well for the purpose, and will economise in the wood a little. Whichever plan be adopted, the piece must be screwed on to the bottom edge of the board I have named, between the scrolls, with screws from the back. Might I suggest to those amateurs who are not so well up in wood-working dodges as others, that in screwing any piece of wood to another in this manner (and there is a great deal of it in the American organ work), that the holes through the board where the heads of the screws come, should be made so that the screws work loosely in them. If this is not done, the piece to be fitted on will fail to come up into its place, and will always leave a space between the two parts.

Above the piece of moulding, and fitted on the face of the part A, is a piece of  $\frac{3}{8}$ -inch walnut, sawn out into the form of Fig. 87; and on the outside of the scrolls, on the parts B and C (Fig. 29), respectively, should be screwed pieces of  $\frac{3}{8}$ -inch walnut, in the form of Figs. 88 and 89. The trefoils in Fig. 89 can be cut with a centre-bit, and the horizontal beads scratched out with the reeder. All the foregoing parts must be fixed in their respective places on the front board, by means of screws from the back.

The next thing to do is to prepare some moulding similar to Fig. 90, 3 inches wide and  $\frac{5}{8}$  inch thick. The whole of it can be made very easily with the aid of the reeder described in Chap. II., page 100. This moulding, as you will see by referring to the illustration of the complete organ, is planted right round the scroll ends, and continued on to the front board until it reaches the middle scroll ends. Be very careful to make good mitres at the various corners, for a bad joint will show the workman up to great disadvantage, and will be an eyesore to everyone. I fixed the moulding on my own instrument with glue, and screws from the front



of the moulding, the heads being countersunk, and the holes made invisible by being fitted with a small piece of veneer; the places will escape detection if done carefully. I am afraid there is no other way to ensure the moulding keeping intact, in spite of the knocks and kicks it will at various times receive by reason of its exposed position.

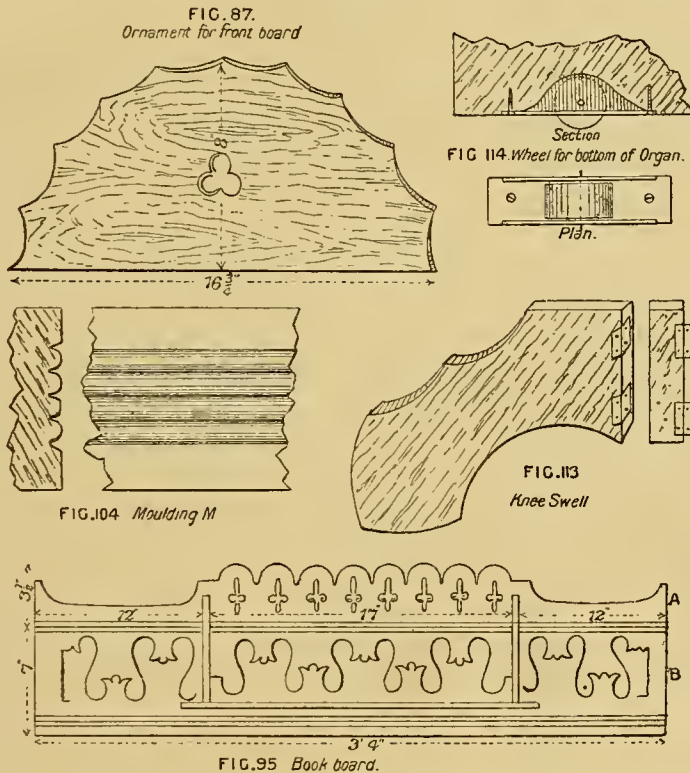
We will next proceed with the fall-board, or lid (Fig. 91). Choose a nice piece of  $\frac{3}{4}$ -inch walnut, a trifle over 3 feet 3 inches long, and  $14\frac{1}{2}$  inches wide, planed down to  $\frac{1}{2}$  inch; it will very likely have to be jointed, on account of the extra width. Shoot the front edge square at first, and with the reeder scratch the three half-rounds shown at A (Fig. 91) at a distance of 2 inches from the front edge. This done, the

edge may be bevelled to the angle shown in Fig. 92, to take the piece of moulding, B (Figs. 91 and 92). At the back of the moulding is fitted a strip of wood, making the width up to 1 inch, in order to take the catch of the lock, which I may as well now describe, although it must not be fixed until the lid has been fitted into its position. The best lock for the purpose is one similar to those used for writing-desks and work-boxes. Mr. Marsh sells a first-class article, silver-plated, for 9d. complete. A mortise must be cut in the centre of key-slip for the lock to be inserted; and I need hardly say that the top surface of the lock should be fitted nicely,

and made flush with the top of key-slip. The catch is, of course, put in the centre of the moulding belonging to the lid we have just made.

The lid must now be fitted to run between the scroll ends on supports, consisting of two horizontal cleats of wood fixed on the inside of the scroll ends in such a position that the under

surface of the lid, when resting on the bearers, just clears the top of the front stop rail. To prevent the lid from running too far back into the case, a couple of screws are driven into the top of cleats, for the end of the lid to come against; and to stop the lid from coming out too far in the other direction, two pieces of wire are driven into the lid on the back edge, with tails bent downward in order to catch into a couple of



screws screwed into the side of the cleats near the front. A little black-lead rubbed on the cleats will help the lid in running smoothly. Fig. 94 is drawn to give a better idea of the runners on which the lid works.

The book-board (Fig. 95) has to slide in two grooves made in the sides of the case, and slopes backwards at an angle of 45 degrees to the top of the case. The principal thing to bear in mind in the placing of the board and the cutting of the grooves, is that the bottom edge of book-board should just clear the lid when resting on its bearers. With regard to the design of the book-board, it is made of  $\frac{3}{8}$ -inch walnut in two



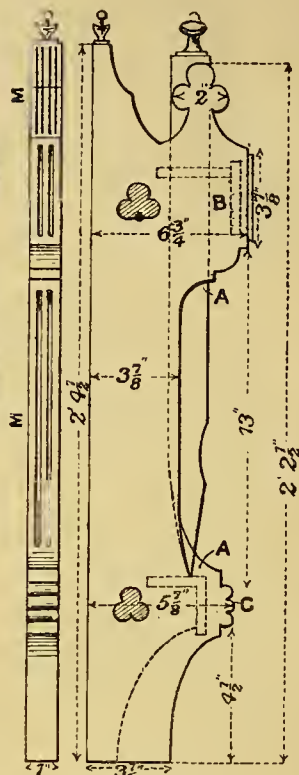
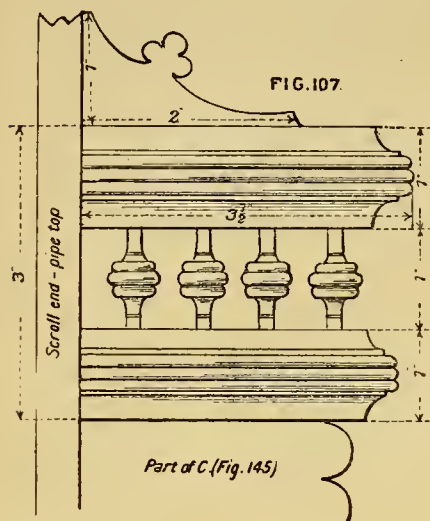
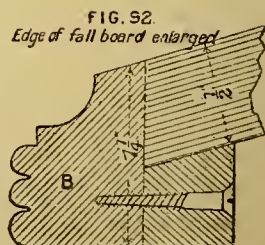
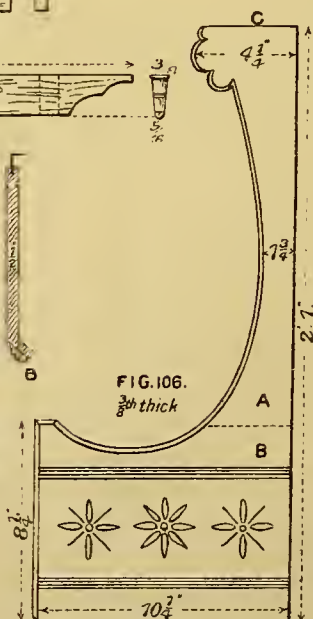
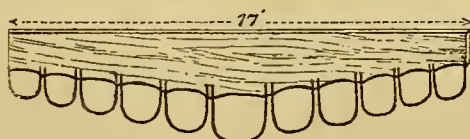
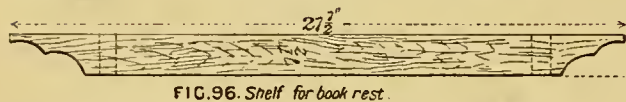
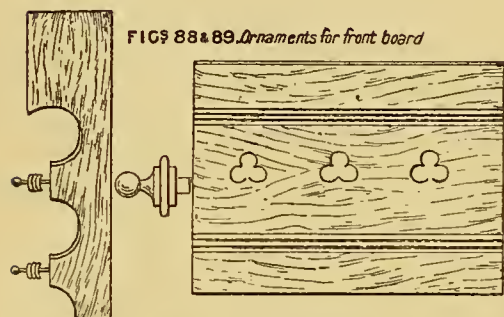
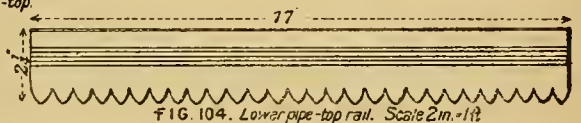
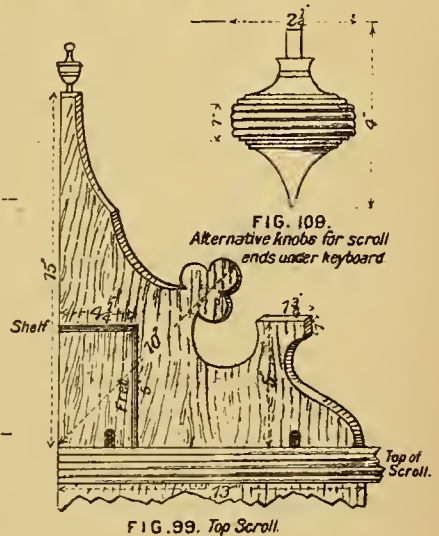
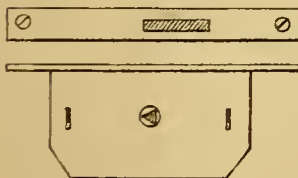
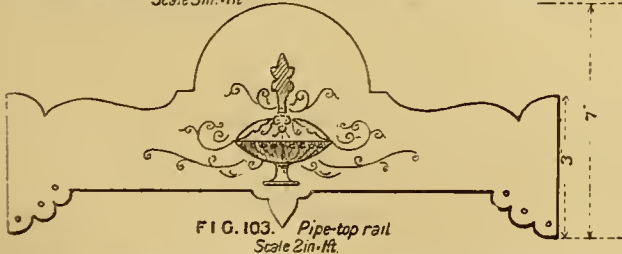
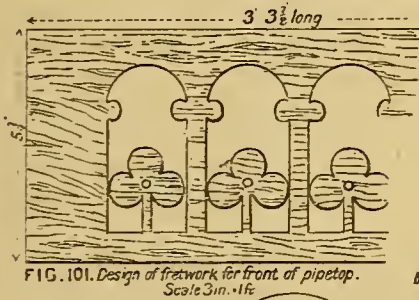
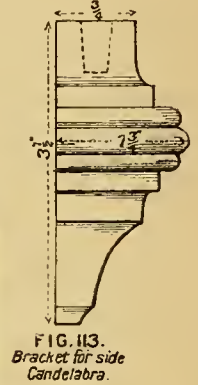
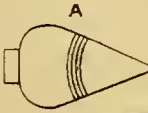
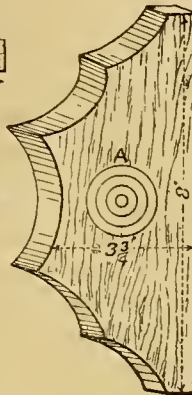
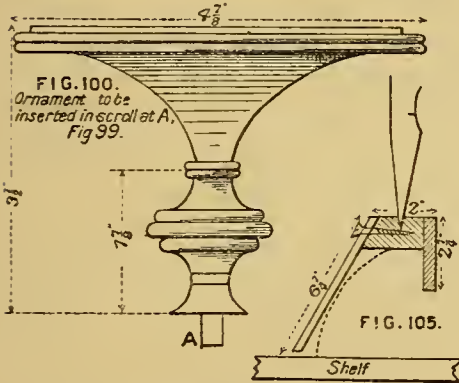
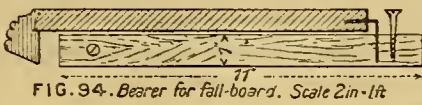


FIG. 110.  
Suggestion for ornamenting pipe.





parts, A and B, and strengthened on the front by the two small scrolls, C, which meet the ledge on which the books and music rest. The design will most likely be found too large for ordinary fret-saws; but if the wood, with the design pasted on, be sent to A. Morelli, professional fret-cutter, Cross Street, Leonard Street, E.C., he will, for a very reasonable charge, cut it out for you in first-class style. If this plan be not adopted, the next best course will be to alter the design into one with panels of fretwork placed behind, similar to that shown in the coloured illustration at the beginning of this Vol. The ledge (Fig. 96) and small scrolls (Fig. 97) are screwed on to the book-board from the back.

Now for the top scroll ends. These must be carefully cut out in the form of Fig. 99, in accordance with the measurements shown therein. Run a moulding along the front edges, similar to Fig. 104, on the parts marked in Fig. 99 with the letter M.

To these scrolls are fixed the various parts of the pipe top, and the whole thing rests on the top of the ends of the case, and is kept in position by wooden dowels fixed in the latter, so that the top part of the organ is removable at pleasure. A false top is fitted between the principal scroll ends; it is not, however, shown by the engraver in the coloured illustration. He has carried the moulding right round the scroll ends, whereas this false top fits just flush with the top of scroll ends, and the moulding ceases when it has reached the book-board. The false top is made out of a piece of walnut,  $\frac{3}{4}$  inch thick, and  $6\frac{1}{2}$  inches wide, and must fit very neatly at the ends, and the front edge must be bevelled to meet the back of the book-board. The top is screwed down by round-head silver-plated screws and washers to a couple of strong cleats fixed in the scroll ends.

The shelf shown at A (Fig. 99) must be fitted into grooves made for that purpose in the scroll ends, 5 inches from the bottom of scrolls. A section of the shelf, showing a moulding, which are to be run along its length on the front edge, is shown in Fig. 98.

A length of fretwork 5 inches broad, and 3 feet  $3\frac{1}{2}$  inches in length, forms the front of the pipe top shelf (Fig. 98), and is fitted between the

shelf and the false top before mentioned. The design of the fretwork is shown in Fig. 101.

This being completed satisfactorily, we will proceed with the cutting out of the pipe top scrolls. Fig. 99 is a drawing to scale of the side elevation. The scrolls are to be made of 1-inch stuff, and the edges must be finished off very smoothly with the scraper. A small three-fold bead, similar to Fig. 104, must be run along various parts of its edge; the parts for the moulding to be applied on the scroll are marked with the letter M. It looks most effective if it be stopped abruptly at the parts A A. The two scrolls, made *exactly* similar to one another, are to be placed 17 inches apart, standing on the shelf, with their back edges in a straight line with the two *outside* scrolls, and equi-distant from them; as a matter of fact, there should be a distance of a trifle over 10 inches between the outside and inside scrolls.

Between the two pipe-top scrolls, at the point B (Fig. 102), a piece of  $\frac{3}{4}$ -inch walnut, cut out in the shape of Fig. 103, is fixed. It must be fastened to the scrolls at the point B with two dowels, and strengthened at the inside corners with two small blocks of wood glued in. Lower down the scrolls, at the point C (Fig. 102), another ornamental slip of walnut (Fig. 104) is fixed, and at the back of this slip, and fixed at right angles to it, is a ledge, on which rest the feet of the pipes.

We may now screw the scrolls down to the shelf by means of long stout screws from underneath. The space between this shelf and the one for the pipes to rest upon can be filled with a piece of  $1\frac{1}{4}$ -inch walnut, with a three-fold bead or other similar ornament running along its edges. A capital idea for filling up this space would be to procure a piece of zinc the exact length of the opening, and about 7 inches wide, and bend it so as to form a curve, on which glue some nice pattern of *Lincrusta Walton*; a lightly painted sketch in sepia, or other similar ornamentation in keeping with the character of the case would look very effective. In Figs. 102 and 105 is shown the mode of fixing the zinc, as well as of the ledge for the pipes.

The spaces between the outside and inside



scrolls on either side must now be filled in. The stuff used need not be more than  $\frac{3}{8}$  inch thick, and the design (Fig. 106) is made in two parts, A and B, in order to save the wood, the join being shown by the dotted line. The beads in the lower part (B) are cut with the reeder before the curve is cut out. With regard to the ornamentation, I must leave it to the individual taste of the worker; but the design given is very simple, and is easily cut out with a sharp carving gouge. An alternative method, to avoid the carving, will be to cut trefoils with the centre-bit, and back the holes with a thin piece of walnut.

The Fig. 107 illustrates the cap for the part we have just finished. The rails are to be 1 inch in thickness, and  $3\frac{1}{2}$  inches long, and can be easily cut out with the reeder and a sharp gouge or chisel. The spindles can be bought in London for a few pence, but if the amateur has a lathe, so much the better; the trefoil at the top can be cut with a fretsaw. The whole of the design (Fig. 106) has to be screwed on to the back of the outside and inside scrolls. Therefore the cap (Fig. 107) should be shifted along the top, so that the butt end comes *against* the side of the scroll; this gives a better finish.

Fig. 108 is a turning to surmount both the inside and outside scrolls, the outside ones to be a bit smaller than the top ones.

Fig. 100 is not so elaborate for the turner as it appears to be; it is first turned in three separate parts, glued together, and afterwards finished off in the lathe. It is a very handsome addition to the scroll end. Similar ones will have to be turned for the outsides of the large scroll ends by the side of the keys, and these should stand on a bracket (Fig. 113).

The back of the organ had now better be filled in. The best thing for the purpose is  $\frac{1}{2}$ -inch match-boarding, fitted into the rebate in the sides of the case, and, of course, made so as to be removed in case anything should go wrong inside at any time. Do not have a calico back on any account; it does so let in the dust. The match-boarding will only cost 1s. 3d. You will want about 24 feet run, providing it is 6 inches wide; strengthen with a broad cleat at each end *inside*.

Wheels, the same as those sold to grocers and

others for the underside of heavy drawers, etc., must be fitted into the bottom of the case. The pattern is given in Fig. 114. Four will be required, and in fixing, place the wheels so that the organ can only be pushed endwise, not backwards and forwards, else the instrument will have a tendency to run away from the performer when being played upon.

Now for the pipes. They are to be made of paper. I do not know that I ought to describe the process of manufacture after the admirable instructions on the subject given in Vol. II. by Mr. Mark Wicks, to whom I am indebted for the idea of adapting them as show pipes; but, shortly given, this was my mode of procedure. I procured a roll of wall-paper, glued up the edges so as to form a mandrel on which I made my largest pipe; when that was finished and dry, I unrolled a yard or two off the mandrel for the next smaller size, and so on until the smallest pipe was reached. The diameters of the pipes, as well as their respective heights, are given in Fig. 110. Their decoration must be left to individual taste, and to suit the general tone of the room in which the organ is to be placed; but the following blending of colours is very nice:—Lower part, or foot, chocolate, extending up to a sharp point *above* the mouth, ending with a gold border; the whole of the flat part round the mouth, gold leaf; the upper part salmon pink, with little darker stencil; the top, a wide chocolate band, bounded by two narrow gold lines, and a gold trefoil in the centre. The pipes look very nice without the knobs shown in the complete organ, so you can do as you like about adding them. They are intended to be made of wood, turned to fit the insides of the various pipes.

The pipes are arranged, and kept in position between the scrolls by a rack similar to Fig. 111, which is fixed on cleats between the scrolls, just behind the front bar (Fig. 103), and which has thin copper wire fixed therein, bent so as to take the pipes.

You will notice that the pipes are not to be placed in a line, but each one a little in advance of the other; the smallest pipe should be so placed that no crack is seen between it and the scroll end when looked at from the side.

The handles at the side of the organ (Fig. 112) must be fixed to the sides of the case by long screws driven into them from the *inside*. The centre bar is, of course, turned in the lathe.

The knee swells (Fig. 113) are to be cut out of  $\frac{3}{4}$ -inch walnut, and hinged at *A* to the top of the centre scrolls in such a manner that when either knee swell is pushed outwards, it may press the wire connected with the interior action. The place where the wire touches the knee swell should be covered with a piece of cloth, to render the action noiseless.

Now about the polishing. The case will look best dead finished, that is, it should be dusted down with finely-powdered pumice-stone, after a good polish has been obtained in the ordinary way. Polish wherever you can in preference to using varnish. I have darkened my own instrument by staining with vandyke brown (ground in water), to which a little pearlash was added. This stain gives a richer effect to the natural wood, and should be done before filling in.

As soon as the carpets are put on the blow pedals, I think we may consider our organ complete; consequently, my task is at an end. I can only say, in conclusion, that I hope every one who has attempted the making of the instrument will have met with as much success as I have in mine. Standing in my parlour, it is a source of pride to me; and I can say, from my own experience, that there is much more pleasure to be derived from an instrument which you have made yourself than is possible from fifty purchased ones.

Before I close I must not forget to redeem a promise made in a former chapter, to give some of the stop-combinations to be obtained out of the instrument. Here are a few, but the variety is almost endless:—

1. { *Treble*.—Melodia, oct. coup. sw. melodia.  
    { *Bass*.—Sub-bass and dulciana.
2. { *Treble*.—Melodia, 'cello, and oct. coup.  
    { *Bass*.—Oct. coup., diapason, and viola.
3. { *Treble*.—Melodia, oct. coup., vox humana,  
    { and principal.  
    { *Bass*.—Sw. diapason, viola, and sub. bass.
4. { *Treble*.—Melodia and 'cello (solo).  
    { *Bass*.—Viola (played an octave lower).

5. { *Treble*.—'Cello and octave coupler.  
    { *Bass*.—Diapason and viola.

6. *A Good Crescendo*.—Commence with melodia and dulciana, and add stops in the following order:—Diapason, swell melodia, principal, viola, 'cello, sub-bass, swell diapason, add oct. couplers 1 and 2 with left knee swell, and lastly, open the swells with the right knee. The effect is grand.

Any further inquiries upon any difficult point I shall be glad to answer through the medium of our Editor, and will give you any assistance which lies in my power.

To those who are wishing for a larger instrument I would say, make the smaller size first; you can always sell it for what it cost you to make; and by and bye, with the Editor's permission, I will endeavour to describe a larger instrument with two manuals and pedals, and with a greater variety of stops. But this is only a promise in the distance.

## A COMBINED ELECTRIC ALARM CLOCK AND NIGHT-LIGHT.

By FRANK S. MORTON.



SEVERAL different arrangements for attaching an electric bell to an alarm clock have been described in back parts of *AMATEUR WORK*, and therefore I shall not claim anything very original in the one I am about to describe, as far as the alarm is concerned. But I think there may be some who are equally as lazy as I am, and who will be glad to have the idea suggested to them that they can arrange an electric lamp on their clock at a very little expense, that will enable them to see the time at night with but very slight exertion. Both clock and light combined will allow one to sleep in peace, and there is but very little fear of oversleeping, or chance for worry that you have. Cold winter mornings it is a luxury, when one has woken up with a dim idea that he ought to be out and away, to be able to press a button or turn a switch, and have the clock dial lighted enough to see the time. With a house fitted with electric gas lighters or regular electric



lights, such an arrangement would be out of place, but it is a first-class arrangement for one who has but little money to put into such an affair.

The works of any clock can be used. I will describe mine as I arranged it, however, and the details can be altered to suit the works at hand. I used the works of an American "Peep o' Day" clock, which are fastened into an iron framework; the case was made of walnut, the front being

On top of this was placed the dial of the clock, which was  $3\frac{1}{2}$  inches in diameter. This left the brass plate exposed  $\frac{1}{4}$  inch all round. The same precaution must be taken in screwing the dial on as with the brass; both can just as well be held with one set of screws. Be sure that neither the hands nor spindle come in contact with brass or dial. Before the brass is fastened in place, a small wire should be soldered to the back of it and run through the case to the inside. Now

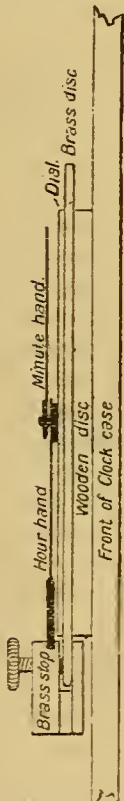


FIG. 1.  
Arrangement of  
dial on case

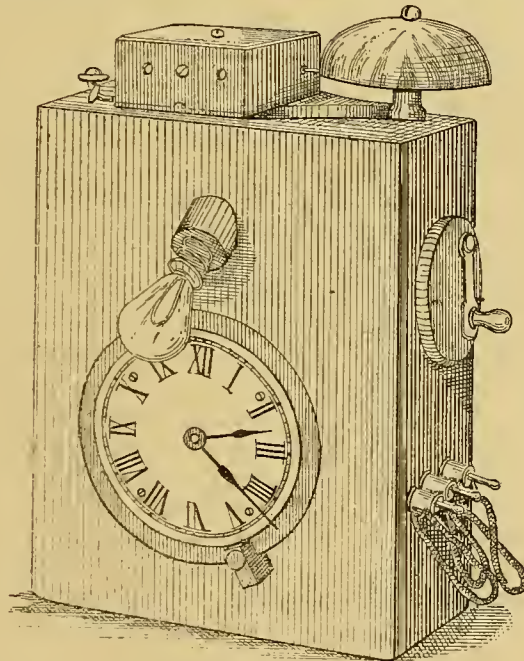


FIG. 4. The apparatus complete.

6 × 8 inches and 3 inches deep. A small hole was bored 3 inches from the bottom, through which the spindle for the hands was passed, and then the works were screwed on the back side

of the front of the case. On the front of the case was fastened a circular piece of wood  $3\frac{1}{2}$  inches in diameter and  $\frac{1}{2}$  inch thick. On top of this a circular piece of brass,  $\frac{1}{8}$  inch thick and 4 inches in diameter, was placed, being held in position by four screws. These screws must be short, so as not to go through the wood of the front of the case, and thus form a connection with the brass plate and the works of the clock.

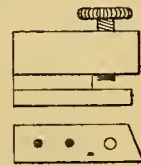


FIG. 2.  
Brass clip made with  
three pieces of brass.



FIG. 3.  
Alternative form of brass  
clip made with wire.

place the hands on the spindle, first lengthening the hour hand by means of a small strip of copper, such as is used for dynamo brushes,  $\frac{1}{8}$  inch wide, and long enough to reach a little way beyond the minute hand. Solder it in place, first dipping the hand, if steel or iron, into a solution of sulphate of copper, to give it a coating of copper to hold the solder. Twist the copper at right angles with the hand, and it is so thin that it can hardly be seen.

Fig. 1 shows the three discs in place, together with the hands after they have been arranged. It also shows the brass stop in place, fastened on the brass by means of a thumbscrew. Fig. 2 shows the stop full size; for convenience, I



made it of three pieces of brass rivetted together, as shown in the figure. It can just as well be made out of one piece, filing a notch in it to fit over the plate, or, if tools are not at hand to make such an attachment, a brass clip (Fig. 3) can be made out of spring brass, to be used by slipping it on over the plate. The thumbscrew is neater, however, and has a surer hold.

Next in order are the binding posts, seen at the side of the clock (Fig. 4). Any style will do, of course connecting them from the inside of the case. Above these put a switch or push-button, as desired, for turning on the light; a one-candle power lamp is sufficient for the purpose; but if anyone desires a more powerful one, the only difference will be that it will require more battery cells to light it. If a lamp without a socket is procured, a socket can be made for it by winding up a small spiral of brass wire, running the wires of the lamp through it, and through a circular piece of wood, as shown in Fig. 4. One end of this block should be cut on a bevel, to allow the lamp to slant down over the dial. Now run the wires of the lamp through the front of the case, and fasten the whole there by a screw from the inside. Be careful that the wires of the lamp do not touch the brass spiral, and form a short circuit.

Everything is now complete but the bell. I used an ordinary bell, and placed it on top of the clock, as shown in the illustration. It can be placed there or anywhere else about the house, as in other alarm arrangements. This clock was designed to be kept on a shelf at the head of the bed, and so was more compact.

The connections with the binding posts should now be made. To explain: I will call the one nearest the face of the clock No. 1, the one next No. 2, and the one nearest the back No. 3. Connect No. 1 with the wire that runs from the brass disc on the face of the clock; the wire from No. 2 goes to one screw of the switch above it; and the wire which runs from the other screw of the switch to one of the wires of the lamp, connects No. 3 post with the other wire of the lamp, and also with one binding screw of the bell. A wire from the other binding screw of the bell to the works of the clock completes the connections.

Now for the battery. Electric lighting with batteries is generally "messy work," and does not pay for the trouble. But in this case our old friend, the Leclanche, stands ready to do the work. Light is needed only at intervals, and then only for a few seconds, and if a one-candle power lamp is used, four cells will be sufficient for the purpose. A closet, a bureau-drawer, or any convenient place near at hand, will do for the cells, as they make no mess, and do not create any smell. Mine are placed in the bottom part of the commode in my chamber, the wires running through holes in the back, down along under the edge of the carpet across the room to the clock. No one would ever know there was an electric arrangement in the room, as far as the wires are concerned. The object of having three wires is this: one cell is sufficient to ring the bell, while all four are needed for the lamp. It would be a needless waste of power to allow the current from the four cells to expend itself in ringing the bell, and it would also weaken the light, so that you could not use it anywhere near the time when the alarm rung off. If convenient, wires covered with three different coloured coverings should be used, so as to distinguish them when connecting up. Connect No. 3 post with the wire running to the positive pole of the battery at one end of the series, and No. 2 with the negative pole at the other end. No. 1 is connected with the negative pole of the same cell as No. 3.

Now everything is complete, screw on the stop, as in Fig. 4, and the bell will call you promptly on time. If you wake up in the night, and are fearful that you have overslept, reach out your arm and turn on the switch, and find out. If you conclude to take another nap after your alarm goes off, push the stop along ten, fifteen, or twenty minutes later, using the light to tell you where to fasten it.

When the hand reaches the stop again the bell will ring until you reach out and take the stop off, or until the battery runs down. A switch could be arranged to cut out the circuit, but the stop is as quickly removed as a switch could be turned. One feature of the clock is that it can be so handily set for any purpose during the day, as the brass dial extends clear around. If your

wife, supposing you have one, puts cake in the oven, and wishes to take it out at the end of twenty minutes, she could affix the stop to the dial a great deal easier than she could keep her eye on the watch or clock. The arrangement could be easily adapted to many uses, and could be changed about to suit different situations.

## HOW TO MAKE A MUSIC STOOL.

By JAS. SCOTT.

“HE more haste the less speed.” Very paradoxical indeed seem these words. Of course, the meaning they would convey is plainly apparent to us all; but what would one say if the words were so transposed as to read, “The more speed the less haste”? And yet haste and speed are really one and the same quality.

The meaning, as everyone knows, of this proverb is the more “flurry” or “fluster” the less speed or haste. Now, persons become flurried with small undertakings, as well as with large ones; and even the adjustment of a music stool is liable to provoke one’s good humour, and, consequently, cause one to act in a flustering manner.

If the adjustment of the stool is not very provocative of impatience, it will often be found that the state of the stool is such as to lead to the same result. Stools become rickety; and this is more especially the case with the screw article. Either from bad workmanship, rough usage, or some other cause, the screw may become loose, and the result be that it is a source of annoyance, if not of absolute uselessness.

It is plainly desirable that a player at a piano or other instrument requires, in addition to being located at a convenient position to it, to be very steady in his seat; and this result cannot be attained by the use of a rickety stool.

In addition to this, whether the article be firm or otherwise, it appears ridiculous in the extreme to see a man or woman perched and supported, as it were, upon a single slender screw. Of course, it is not everybody who requires to extend the stool to any very great height, but it

does frequently happen that a comparatively diminutive lady or gentleman has to do so before she or he is in the proper position to play.

My remarks have applied more particularly to the screw stool, because that pattern is almost exclusively the only kind made. It does seem strange that our designers have not paid more attention to this article of furniture. Musical instruments, and more especially pianos, are so very popular that there has been, is, and probably always will be, a demand for music stools. Certainly there are some stools that can claim an advantage in appearance over the screw article; but, then, few of them are adjustable.

Knowing the ungratified demand which exists for something different in appearance, and firmer than the ordinary stool, and yet be adjustable, I have designed the one here shown. It will afford a much steadier support than the old pattern, if made as it should be. My readers have, no doubt, had sufficient instructions as to wood-working from pens more competent to give them than mine, so I will say nothing more on that point.

In Fig. 1 the stool is shown closed. There are, it will be seen, three legs, terminating in scroll feet, which are united by a top framing and a bottom board. I might say that a good way to join these will be to dowel them, which process is shown by Figs. 3 and 4; in the former diagram, *A* representing the under framing, and *B* one of the legs; and in the latter, *B* representing one of the legs, and *C* a corner of the bottom board.

Along the inside surface of each leg will run a rack. The length of it will be determined by the difference in measurement between the height proper of the stool and its extreme adjusted height; by which I mean that, supposing the height of the stool is 16 inches, and the full height to which it may be adjusted is desired to be 24 inches, the length of each rack will be 8 inches.

I should advise the use of brass racks, inserted and screwed into the wood, as shown by section in Fig. 5, *A* representing a rack. In lieu of this, notches can be cut in the wood itself, provided it is of a hard quality.

As an addition to ornamentation, I have



placed under the frame, at the top of each leg, a small carved bracket. These brackets, of course, could be made separately, but I should advise each shaft and foot to be shaped from one solid piece.

Down the centre of each leg, from the top for an inch or so distance deeper than the bottom end of each rack, will be drilled a hole to receive a (preferably) brass rod, one end of which latter will be inserted in the movable framing of stool. These rods, and the holes in which they will work, must not be very stout or wide; for if

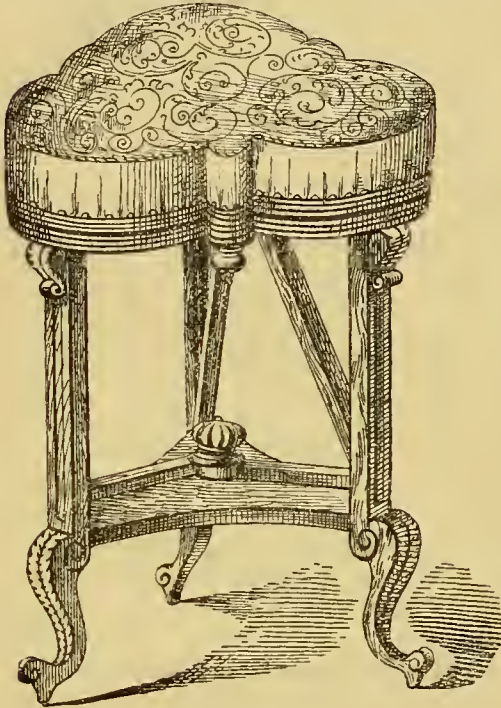


FIG. 1.—STOOL CLOSED.

they are, there will be less thickness in each leg in which to imbed the rack. They do not serve in any way whatever as a support, their only purpose being to properly guide the seat whilst it is being adjusted.

Our attention must now be paid to the principal feature of the article: this is the triangular-looking framework under the seat. The bottom part of it consists of three rails, joined to a circular ring, as shown in Fig. 6, in which ring will be glued a knob, also shown in this diagram.

Hinged to the end of each of these rails will be another rail, the top end of which will have a hole bored through it to receive a pivot, in order that it may work along underneath the seat. The latter should consist of two framings, one on to which to tack the cushion, and the other to accommodate the pivots on the ends of

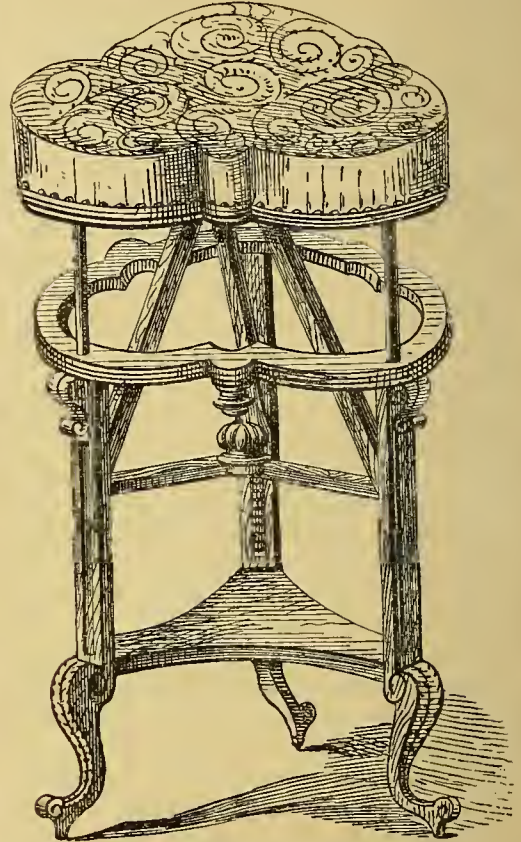


FIG. 2.—STOOL ADJUSTED.

the rails just mentioned. Fig. 7 shows the second framing. Three rails, shaped as shown in section in Fig. 8, for part of their length, will be joined flush with this framing. As this diagram shows one end of a rail, it will be understood how they travel along the under part of the seat.

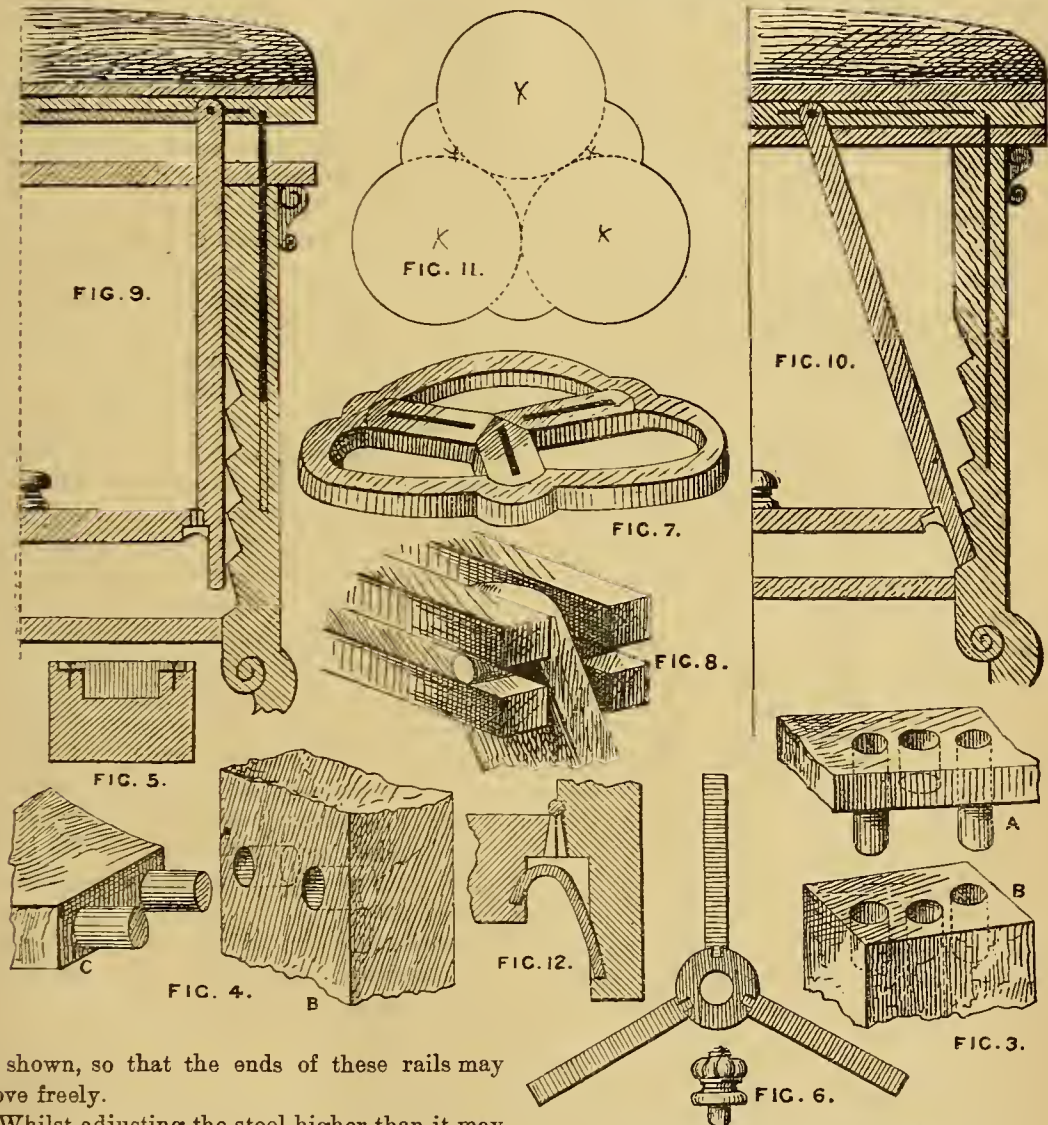
Just below where these rails, and those shown in Figs. 1 and 2, are hinged together, a steel spring must be fixed; thus, when the seat is raised, the slanting rails are drawn into a perpendicular position, as shown in Fig. 9, and the



end of each will spring into one notch as soon as it arrives just above another. It is to allow these rails to be drawn to a perpendicular position, that part of the seat framing is made

will be found a comparatively easy matter to lower it.

As this article is adjustable, I will not give any measurements for the reader to work to,



as shown, so that the ends of these rails may move freely.

Whilst adjusting the stool higher than it may happen to be, it will fix itself, and require no further touching; but when it is desired to lower the seat, the latter must be drawn upwards, until the slanting rails assume an upright position, as in Fig. 9, and, not allowing them to spring back into the notches, the hand must hold the knob shown on the cross rails, when it

#### DESCRIPTION OF FIGURES.

FIGS. 3 AND 4.—SHOWING METHODS OF JOINING TOP FRAMING AND LEGS, AND BOTTOM BOARD AND LEGS, RESPECTIVELY. FIG. 5.—SECTION OF LEG, SHOWING RACK. FIG. 6.—RAILS TO WHICH MOVABLE UPRIGHT RAILS ARE HINGED, AND ALSO SHOWING KNOB TO FIT INTO THE FORMER. FIG. 7.—UNDER-FRAMING OF MOVABLE SEAT. FIG. 8.—SECTION OF STRAIGHT PARTS OF UNDER-FRAMING OF SEAT. FIGS. 9 AND 10.—SECTIONS SHOWING HOW LONG RAILS WORK INTO NOTCHES WHILST SEAT IS BEING ADJUSTED. FIG. 11.—SKETCH PLAN OF SEAT. FIG. 12.—SPRING BETWEEN BOTTOM RAILS AND LONG UPRIGHT RAILS.

for some may prefer a certain height, while others would deem a much higher or lower stool necessary. A tall man would sooner have a short stool, because he would not have to raise the seat very high when about to use the stool; but a short man would consider a low stool abominable, as he would then have to extend it to an unsightly degree. And as thickness of legs, etc., must be in proportion to the size of the stool, it will be apparent that it would be useless to pretend that by following certain given dimensions advantages would be gained.

Certain articles of furniture are always made the same size by professional makers, for the simple reason that when they have once drawn out full-sized working drawings, and shaped their moulds, they feel reluctant to experience extra trouble by working out a second set. Why should not furniture be made to accommodate its users to the same extent as clothes? The latter are made to suit size and form; therefore the former should be so made when considered desirable.

My advice to intending makers is to draw a plan of the seat and framing, after Fig. 11, to the size he considers most convenient. In this diagram I show the centres from which to strike the circles, to obtain the proper form. When the plan is cut out, the best height at which to fix the seat can be ascertained by comparing the sizes of different chairs; and then an idea of the best thickness of different parts can be had by rough sketching on the plan, and on another sheet of paper. When all is decided upon, a final set of working drawings can be made.

Fig. 10 shows the most appropriate angle at which the slanting rods may be fixed; and the length of them can be determined by a comparison of the other parts represented in my diagrams in connection with them.

A properly stuffed seat would be preferable; but as few would be likely to endeavour to accomplish this, my advice is to cut two pieces of material the shape of the seat, one to be, when stitched, the size of the seat, and the other to have an overhanging edge all round, by which it may be tacked to the seat framing by means of brass-headed or plush-covered studs; the cushion to be filled with some suitable stuff to form a comfortable seat.

## A SIMPLE MILLING ATTACHMENT FOR FOOT-LATHES.

By F. J. G.

**A**S most amateur turners endeavour to render their lathes universal machines, by fitting circular saws, emery wheels, etc., thereto, it is hardly necessary to apologise for bringing the above appliance under their notice. Every amateur who follows metal turning (and whose pockets are not deeply lined), frequently finds it necessary in the manufacture of the thousand and one objects which pass through his hands, to file, say, a groove or slot in the work, or to true up a surface which cannot be readily reached with a file. Again, in making taps and dies, a filed flute in the former, or V in the latter, may do for rough work, but certainly is not very satisfactory, especially if, as should always be the case, the amateur endeavours to finish everything he undertakes to the best of his ability. Now, with the aid of the above simple and inexpensive attachment, which can be fixed to the lathe in a minute, and as speedily removed, such work as this can be expeditiously and easily performed; thus not only enhancing the appearance of the articles, but their value, by the accuracy with which they will perform their various uses. The amateur desires, say, to make a mechanical stage for a favourite microscope; this apparatus is the very thing needed, as it will finish the V's of the slides, etc., in a manner which will leave the file far behind.

Having thus shown a few of the ways in which the attachment will be of use, we may proceed to consider the construction of the device itself; and as it was designed and fitted to a 3-inch lathe, we will assume we are working to the same size. It can, of course, be modified to suit any size of lathe.

Pre-supposing that the amateur has a slide-rest to his lathe, this is secured to the bed in the usual manner, and the distance from the bed to top plate of slide-rest measured; in this case,  $2\frac{1}{2}$  inches, and the tool plate  $2\frac{1}{2}$  inches by  $2\frac{1}{2}$  inches. A piece of iron is required  $\frac{5}{16}$  inches thick, 3 inches wide, and of sufficient length to be forged



into a right angle, one arm being  $2\frac{1}{4}$  inches long, and the other  $3\frac{1}{4}$  inches. We can entrust the village blacksmith with this part of the work, at the same time giving him a square cut from a piece of tin-plate, with the arms of the length required (Fig. 2). Whilst this is being done, we will make a chuck for holding the milling tools. It is an ordinary plain drill-chuck, with the front end bored out to take  $\frac{1}{4}$ -inch round steel (Fig. 3), of which the tools are made.

Our angle plate will now be ready. First file it all over, making the ends nice and square; then, in the longest arm,  $1\frac{1}{4}$  inches from the end, drill a hole of sufficient diameter to pass over the tool-post, so that by tightening up the nut we may clamp it firmly to the top of the slide, the other angle being then parallel with the mandrel headstock. We now drill 3 holes,  $1\frac{1}{4}$  inches apart, in the vertical arm of the angle-plate,  $\frac{3}{4}$  inches from the bend (as shown at Fig. 4), and tap them for  $\frac{1}{4}$ -inch screws. In the centre hole screw a short stud to project, say  $\frac{1}{4}$  inch or  $\frac{3}{8}$  inch; this being a permanency, the hole may be countersunk at the back, and the stud lightly rivetted in. We now come to the most costly part of the apparatus—the vertical slide. Sets of slide-rest castings can now be purchased, ready planed, at about 6s., and we only want the top slide. Taking the casting on which the tool plate slides, we find underneath a circular plate; drill a  $\frac{1}{4}$ -inch hole in the centre of this, to fit the stud in the angle plate, upon which the casting revolves, and can be clamped at any angle required. Hexagon-headed screws pass through the two slots in the circular plate, and into each of the holes already tapped to receive them (Fig. 5). The next thing is to fix the tool plate with its loose V-strip together, so that the whole may slide up and down the main casting freely, but without shake; in fact, it is a counterpart of the top slide of our slide rest. A screw handle is, of course, required to raise or lower this sliding piece; but as no great accuracy is needed, the screw can be cut with stock and dies to  $\frac{1}{4}$  inch, and a brass or gun-metal nut screwed to the sliding piece, near the top, through which the screw works. Taking off the slide, we drill, say, 4 or 5 rows of holes  $\frac{1}{2}$  inch apart, and tap them for  $\frac{1}{4}$ -inch screws.

The attachment is now complete, if we except a few screws and clamps for holding the work to be operated upon. A very useful clamp is that shown attached to the apparatus (Fig. 1), where A is a strip of brass or iron  $\frac{1}{2}$  inch wide and  $\frac{1}{2}$  inch thick, attached by two screws passing through it into two of the tapped holes in the slide. B is a screw with  $\frac{1}{4}$ -inch thread, and  $\frac{1}{2}$ -inch square head, drilled and tapped to take the tightening screw, as shown. Two of these may be at times necessary, and on being screwed up hold firmly any piece of work to be milled or slotted.

For grooving taps or drills, a clamp similar to Fig. 6 is required; this is simply a piece of  $\frac{1}{2}$ -inch iron of the length required, turned up at the ends, as shown, and fitted with pointed screws, the whole being attached to the bed-plate by two screws.

Having now completely finished the apparatus, we will proceed to groove out, say, a tap, attach the clamp just described firmly to the bed-plate, and fix the tap between the centre-pointed screws, tightening them up sufficiently to prevent its moving under the cut. By means of the vertical slide, adjust the top until its centre coincides with the lathe centres, or if a trifle above them, a better cutting edge will be given to the tap. Now fix in the drill chuck a tool similar to A (Fig. 7), clamping it securely with the set screw. If the lathe be set in motion, and the top slide of rest advanced so that a light cut will be given, on traversing the apparatus by the lower handle of slide-rest a groove will be cut in the tap, the counterpart of the drill used. Having reached the end of the tap, set the apparatus to take a deeper cut, and reverse the direction of the traverse, and the groove will be deepened. Four or five cuts will be required, according to the depth of groove desired. The centre screws of the clamp (or one of them) are then loosened, and the tap revolved  $\frac{1}{3}$ ; tighten up and repeat the cutting. On revolving the tap another  $\frac{1}{3}$ , and repeating the cutting process, the operation is complete, the result being a perfectly grooved tap equal to one purchased. To secure the flutes being all the same depth, a block or stop should be used, as in the figure of the complete apparatus. Splendid



drills can be made in the same manner from round steel, grooved on opposite sides; drills formed in this manner are almost, if not quite, equal to twist drills. Various shaped drills for

small size and low cost, will be found of inestimable value, as by means of suitably shaped drills a great amount of varied work can be performed.

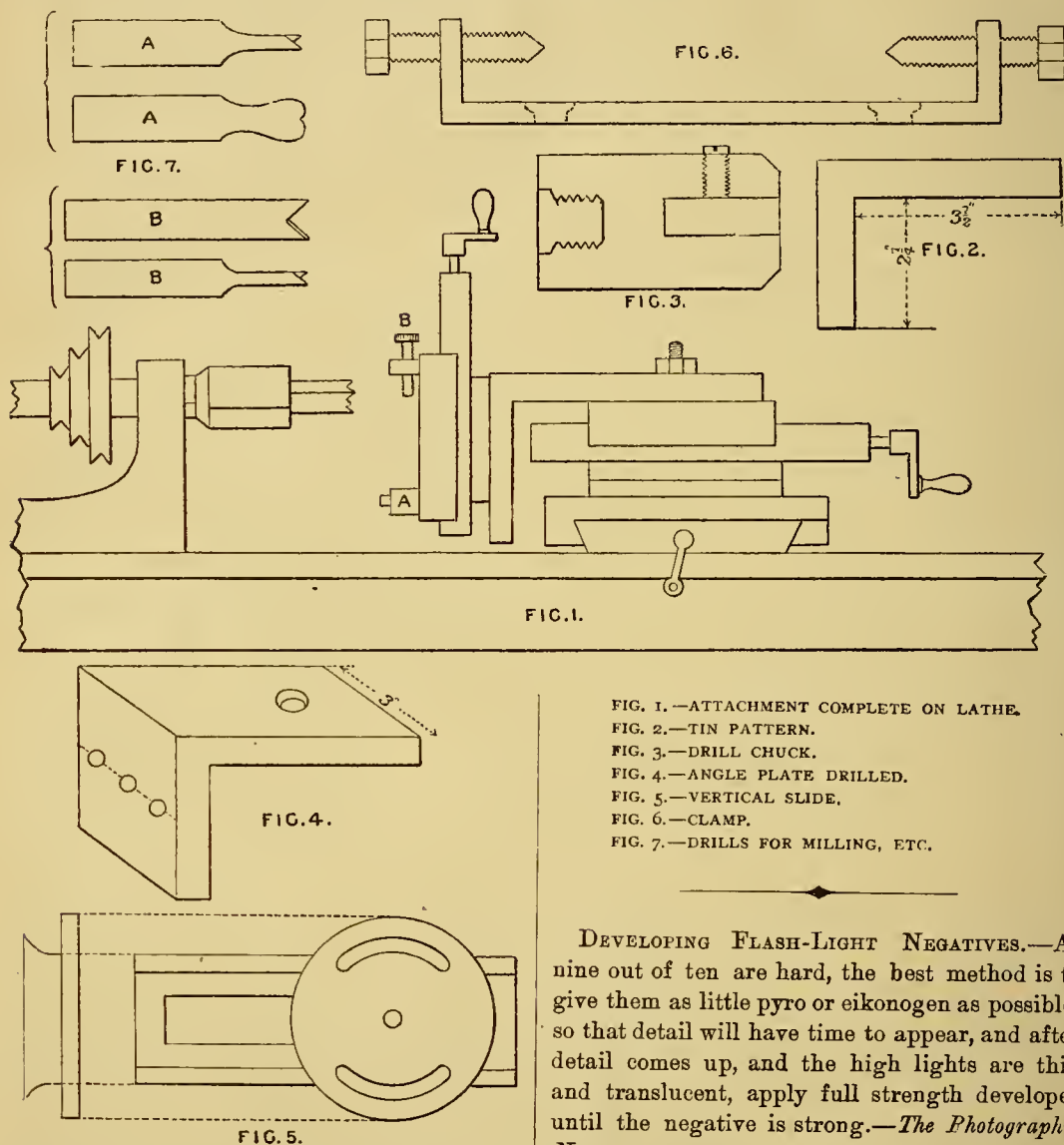


FIG. 1.—ATTACHMENT COMPLETE ON LATHE.  
FIG. 2.—TIN PATTERN.  
FIG. 3.—DRILL CHUCK.  
FIG. 4.—ANGLE PLATE DRILLED.  
FIG. 5.—VERTICAL SLIDE.  
FIG. 6.—CLAMP.  
FIG. 7.—DRILLS FOR MILLING, ETC.

**DEVELOPING FLASH-LIGHT NEGATIVES.**—As nine out of ten are hard, the best method is to give them as little pyro or eikonogen as possible, so that detail will have time to appear, and after detail comes up, and the high lights are thin and translucent, apply full strength developer until the negative is strong.—*The Photographic News*.

milling out special work will readily suggest themselves to the amateur. Fig. 7 (B) shows one for milling out a slot or groove having a flat bottom.

The apparatus here described, although of

FLY SPECKS, etc., may be removed from bronze by means of a mixture of lavender oil, one drachm; alcohol, one ounce; water, one and one-half ounce. Use soft sponge, and proceed quickly, with as little rubbing as possible.

## HOW TO MAKE A SET OF PORTABLE HANGING BOOKSHELVES.

By A WORKER.

**P**ORTABLE bookshelves of the kind described here can easily be made by any amateur, and are so arranged that they can conveniently be packed away into a small compass. The sides are formed of two pieces, out of 11-inch stuff, to finish  $10\frac{1}{2}$  inches wide, having the front edges rounded, and being 2 feet long, with the ends neatly finished off. These two pieces should finish just 1 inch thick.

There will be three shelves, each finishing  $\frac{5}{8}$  in. thick, 9 inches wide, and 2 feet long. Each shelf will be made of two pieces 1 foot

shown in Fig. 4, which is a front elevation of the shelves when ready for use. A hole drilled with a centre-bit enables the shelves to be hung against the wall, if desired. The edges of the hole, and the curved cut edges above it, should be rubbed smooth with glasspaper. If it be thought desirable to steady the shelves, screws may be inserted through the back into their back edges.

When the shelves are to be packed up, the back is unscrewed and folded, as indicated in Fig. 3, while the sides and shelves will fold up together, as shown in Fig. 5, from which the arrangement of the hinges will be understood. The hinges should be strong, of suitable size, and should be fixed three or four in a row. Shelves of this kind may be made of various sizes, as required, and may be



FIG. 3.—METHOD OF HINGING SHELVES.

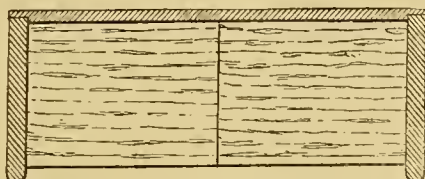


FIG. 2.—PLAN OF SHELVES OPEN FOR USE.

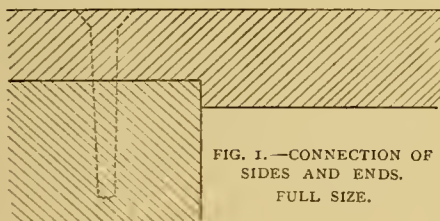


FIG. 1.—CONNECTION OF SIDES AND ENDS. FULL SIZE.

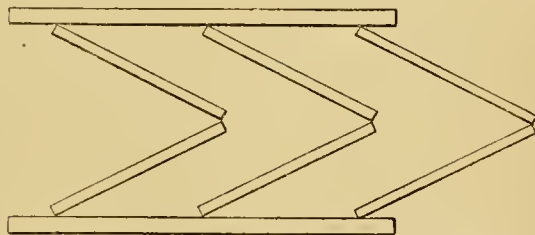


FIG. 5.—SIDES AND SHELVES FOLDED TOGETHER.

long, hinged together in the middle, as will be described further on.

The back will finish  $\frac{1}{2}$  in. thick and exactly 2 feet 2 inches long, the grain running horizontally, and the ends being rebated and screwed to the sides, as shown in Fig. 1, full size.

Fig. 2 shows a plan of the shelves when open for use, to a scale of 1 inch to the foot. The back is made in three 9-inch widths, hinged together, as shown in Fig. 3. One of these widths, that which is to be placed uppermost, is cut to the form

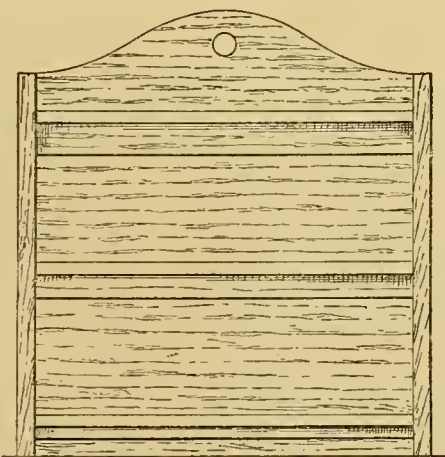


FIG. 4.—FRONT VIEW OF SHELVES COMPLETE.

differently treated according to taste, the edges of the shelves and the sides being moulded, rounded, or reeded at pleasure.

Seeing how cheaply such tools can be bought, it is surprising how few amateurs possess a moulding plane of any sort; and yet the difference that a finish of some kind makes to a piece of work is wonderful. A remarkably cheap and useful tool is supplied by Messrs. Harger Brothers, *Settle, Yorkshire*; it is called a hand-reeder and moulding tool, and the price is 1s. 9d.

## PHOTOGRAPHIC PRINTING PROCESSES.

*By A PRINTER.*

III.—APPARATUS USED IN SILVER PRINTING—COMMON PRINTING FRAMES—MARION'S POLISHED PINE FRAMES—DURNFORD'S PATENT FRAMES—LANCASTER'S SIDE-CLIP PRINTING FRAME—LANCASTER'S TRIPLE PRESSURE FRAME—VIGNETTERS—MARION'S SERRATOR—TYLAR'S VIGNETTE HOLDERS—THE "PERFECTION" ZINC VIGNETTERS—"PREMIER" WAX PAPER VIGNETTERS—MASKS AND DISCS—CLOUD NEGATIVES—PRINTER'S INDICATORS—THEORY OF SILVER PRINTING.



THE only possible way to turn out good prints from good negatives is by using the proper apparatus, and that of the best kind, for the printing operations. It is impossible, for instance, to obtain clean and sharp prints by using those cheap gingerbread frames, with which the market is now literally flooded. In these the springs soon get so weak, that the back of the frame is almost certain to move during the opening and closing of the springs when examining the prints. My advice, therefore, is to pay a good price for printing frames, and obtain an article that will keep together for a reasonable amount of time. A well-made frame will, without any exaggeration, last a photographer a lifetime. The most common type of frame is well known. They are made of some hard wood, such as teak or oak. In purchasing this class of frame, see that the corners are well secured with screws, not nails, and insist upon having steel springs, instead of the usual brass article, which quickly gives. A very strong, nice-looking, and well-made frame is that made and sold in polished pine; and these are, I believe, of French manufacture. It, moreover, possesses a feature which makes it the most useful and reliable frame extant, and that is that swivel springs are used, which work from the centre of the back-board, the frame being closed by pressing the spring at both ends with the thumb, and pushing it under two fixed pieces of projecting brass at each side of the frame. I have used these frames continually for some years, and have never spoilt a print through the blurring of the image; and this merely because the movement of the springs is so arranged as to counteract all tendency of the back to move during the

process of inspecting the prints. These frames are made by the well-known firm of Marion and Co., 22, Soho Square, London, W., whose name is ample guarantee for the excellent quality these frames possess.

A very useful frame, especially for travelling purposes, is Durnford's patent metal printing frames, made by William Tylar, of Birmingham. It consists of the ordinary back of a printing frame, with an attachment on the sides for securing the negative and the back securely together, with the sensitive paper in between. These frames are of great advantage where space is an object, as they are very light, and pack away in a quarter the space of the ordinary frames, folding up double when not in use; hence they are just the thing for tourists going on a long voyage. Messrs. J. Lancaster & Son, Birmingham, have lately brought into the market two very useful printing frames, and both are capable of answering every expectation in the way of good work. In one case they have a side-clip arrangement, in which the clips are opened outwards when it is required to open the pressure board. The springs are fixed, so there is little likelihood of the board and print being shifted. The prices are: 9d.  $\frac{1}{4}$ -plate, and 1s. 6d.  $\frac{1}{2}$ -plate; so the frames are not dear. The other frame is of more improved manufacture, and has no less than three springs on the pressure board, the latter also being in three portions. This frame is called the mahogany triple-pressure printing frame, and it is claimed that there is no unequal pressure when using it. Besides the two ordinary springs there is also a swivel spring in the middle, and this spring is never opened at all after once being closed until the picture is sufficiently printed, so that it is a very safe frame to use. The prices run: 1s. 6d. for  $\frac{1}{4}$ -plate, 2s. 3d. for  $\frac{1}{2}$ -plate, and 3s. 6d. for whole-plate.

*Vignettors.*—Both views and portraits are often improved by being vignetted, and there are many contrivances sold for carrying out this work. The most simple article for vignetting purposes is a piece of cardboard cut out to the required shape, and serrated round the edges with a pair of scissors, or, better still, with Marion's



"Serrator." The cardboard is generally tacked on to the frame, which in course of time greatly damages it. This old-fashioned method is now, however, almost superseded by "Tyler's Vignette-holders," sold at 9d. per dozen, in boxes. With these useful little helps it is possible to move the vignetting shapes during printing, and thus obtain softer gradation. The holders are equally useful for either cardboard, zinc, or wooden shapes. The cardboard shape is now meeting with a formidable foe in Tyler's "Perfection" zinc vignettors. These zinc shapes are pierced in such a way that perfect gradation is secured in the shading without the necessity of using tissue paper during the printing. They are made in two shapes: oval, for views, etc., and "pear" shape, for portraits, and are sold in sets of three; or a box containing six  $\frac{1}{4}$ -plates, with different pear-shaped openings, can be had for the very moderate price of 3s.; set of three  $\frac{1}{2}$ -plates, pear or oval, 2s. 6d. Messrs. Perry, Lund and Co., of Bradford, have introduced some waxed paper vignettors, which they style the "Premier." The manufacturers say that they print nearly as quick as clear glass, and have a softening effect on the retouching, also produce same softness and delicacy of effect in the strongest summer sunshine, or shade of a winter's day. As far as I have tried these waxed paper vignettors, I find that if printed in sunshine, the wax in the paper melts and spoils the print, whilst if the frame is placed in the shade, the printing is terribly slow. The prices run from 3s. per dozen cartes-de-visite, upwards.

*Masks and Discs.*—These are pieces of black opaque paper with openings sharply stamped out in various shapes, oval, arched, square, dome, and cushion being the shapes mostly used. They are used when a white margin on the sensitized paper is required. Sold in boxes at 1s. each.

*Cloud Negatives.*—There are various forms of cloud negatives offered for sale, such as Wyles', and Perry and Lund's "Professional." These negatives are used for printing in clouds where such are absent in the landscape or ordinary negative. This is done by what is known as

combination printing (to be afterwards fully described). Lund's wax paper cloud negatives are both cheap and useful, as in many cases the work can be done in one printing; and as the negatives can be used on either side, two effects can be obtained from the one study. Glass negatives are more expensive; but it is not a very hard task for the amateur to make his own cloud negatives. To do this successfully, a day must be chosen when some suitable clouds are about; the smallest stop must be used, and an instantaneous exposure given on a slow plate. The most effective studies are obtained from clouds which are lighted from the side.

I have now described the apparatus necessary for making a start in silver printing. There are, however, some useful little things called "Tyler's Printers' Indicators," which I should mention before leaving this part of the subject. These are pairs of small brass dials with hands, for attaching to the side of the printing frames. Their use is to state the number of prints required, and to register the printing as it proceeds, and so preventing more prints being taken than are required. We will now take up plain printing.

*Silver Printing on Albumenised Paper.*—According to Captain Abney, when silver nitrate is brought into contact with an organic substance, the resulting compound is found to be affected by light in a somewhat peculiar way; the compound slowly darkens to a red tint; the exact chemical reaction that takes place is very difficult to trace, but it may be accepted that an oxide of the organic matter and silver is formed. This oxide is stable, unlike the silver oxide, and is not acted on by fixing agents to any great extent. If a paper be coated with albumen in which has been dissolved a certain quantity of a soluble chloride, and floated on a silver solution, both chloride and albumenate of silver are formed; but it depends on the strength of the solution as to what proportion of each is present, owing to the fact that the organic compound is much slower in formation than the chloride, and has less affinity for silver. Again, free nitrate of silver is always present. During printing the silver chloride becomes reduced to a sub-chloride, evolving chlorine gas. This

chlorine has a stronger affinity for silver than has nitric acid (which nitrate silver contains), and consequently it combines with the silver, forming new silver chloride, which in its turn enters into a combination with the organic matter, liberating nitric acid. This freshly-formed chloride, in its turn, blackens by the action of light, and adds to the strength of the image formed. If the free silver nitrate were absent, we should have the chlorine attacking the darkened chloride of silver already formed, and partially bleaching it. The results would be "mealy" prints, in which minute red spots alternate with darker ones in the shadows after fixing.

It will thus be seen that the image of a print is formed by the reduced chloride, and also by the organic salt of silver. The organic salt is sensitive to different radiations to those to which the chloride is sensitive, and much depends on the quality of the light as to which salt of silver is most attacked. Consequently, after the succeeding operations of toning and fixing, the appearance of the prints in the two cases would be somewhat different.

When a silver print is plunged into a solution of hypo-sulphate of sodium to fix it, the coloured albumenate of silver is very little affected, but the darkened chloride is dissolved in a great measure, leaving a quantity of metallic silver behind that is probably equivalent to the chlorine expelled from it by the exposure to light. Hence the image is considerably reduced in intensity, and what remains is of an unpleasant reddish tint. To obviate the reduction in intensity, it is necessary to expose under the negative until the depth of colour produced is much darker than is desired in the finished print; and to obtain a pleasing colour, the operation of toning is resorted to before fixing.

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REPAIRING LEAKY SKYLIGHTS.—Instead of repainting the outside of the sash bars with oil paint, give them one or two coats of tar, to which is added a little tallow.—*British Journal of Photography.*

## A NOVEL MUSICAL INSTRUMENT.

By JACK HORNER.

HE winter season is again upon us with its long, dark evenings, and their accompanying recreations. Foremost among these has been, and always will be, music. While the old favourite instruments still continue to delight us with their pleasing strains, some of us feel a desire for a little change now and then, and every novelty is hailed with delight as an additional source of amusement and pleasure.

The last novelty which I brought under your notice was the humble household bellows, in which we have ready to our hands, without even the slightest modification, a most complete wind instrument capable of producing with a little practice excellent music, and never failing to excite the wonder and applause of juvenile and even more mature audiences.

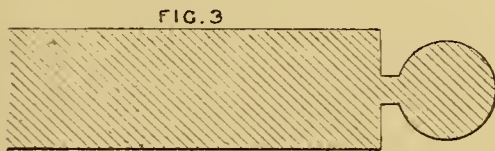
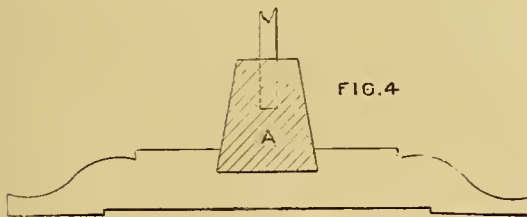
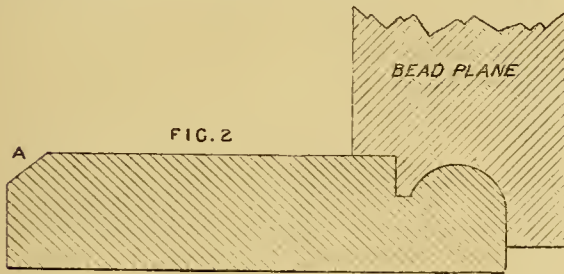
The instrument which I am about to describe will require a little trouble to construct; but the result will amply repay the amateur for his pains, and the expense is trifling.

For the principal part, marked A, in Fig. 1, take a piece of thoroughly seasoned yellow, white, or red pine 4' 8" long and 5" by 3"; this must be planed to the shape shown at Fig. 4, which is a cross section.

Next get sufficient fine yellow pine, dry and free from shakes or knots, to make the upright rods. These rods require to be made quite straight, smooth, and round,  $\frac{1}{2}$ " in diameter; the quantity will depend on the number of notes you decide upon having, as will also the length of the bar, A. The sizes given in this article are for an instrument containing 19 rods, which gives a compass of  $2\frac{1}{2}$  octaves.

Perhaps the best plan for rounding the rods will be as follows: Get your wood in the form of a first quality deal or waney board about 10 feet long, any breadth you find convenient, and  $\frac{5}{8}$ " thick. Take a  $\frac{1}{2}$ " beading plane, and fixing the board flat on your bench, run a bead on the face at one edge, as at Fig. 2; A, in this Fig., shows the slight chamfer which you must first take off with the jack plane to get the bead to work easily.

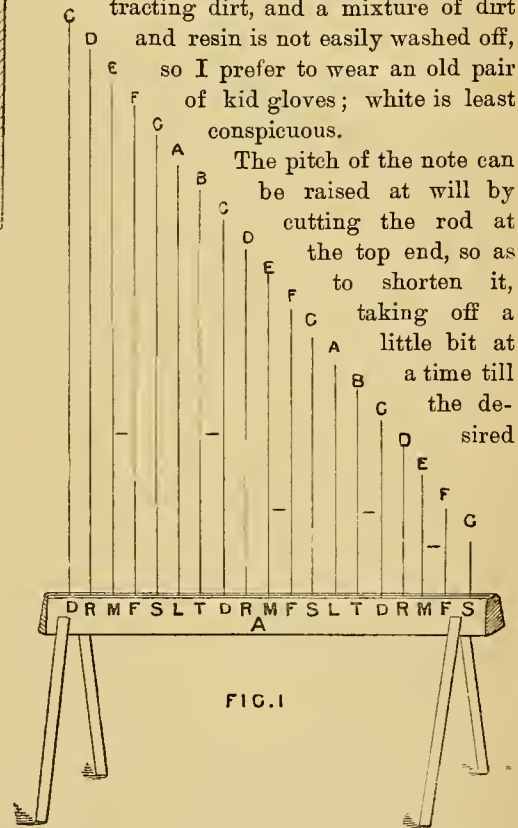
Then turn the board upside down, fix as before, and run another bead on the same edge; Fig. 3 shows the result. If the plane is in good working order, you will now have a rod almost a true circle, which will easily split off, and when planed at the split portion, and sand-papered, is ready for our purpose. Proceed in this manner till you have a sufficient quantity of rods, planing the edge of the board after the removal of each to keep it straight.



Then bore with a brace and bit a row of holes 3" apart between centres, and about 2" deep along the centre of the bar, A, taking care that they are the proper size to be a tight fit for the ends of the rods. When boring these holes a very good plan to ensure perpendicularity is to have a friend stand a little way off, and to keep his eye on the brace; he will be able to see the slightest inclination, and warn you to keep plumb.

Cut one of the rods to 5' 4", and glue one end firmly into the end hole. To produce the tone, get a pair of kid gloves, old ones if possible, as they will be rendered useless for wearing, and after putting them on rub the palms well with powdered resin. On passing the hand down the rod, and exerting a slight pressure, a beautifully clear and mellow note of considerable power should be the result. The naked hands may be used, and perhaps with better results; but powdered resin has the effect of attracting dirt, and a mixture of dirt and resin is not easily washed off, so I prefer to wear an old pair of kid gloves; white is least conspicuous.

The pitch of the note can be raised at will by cutting the rod at the top end, so as to shorten it, taking off a little bit at a time till the desired



pitch is reached, which can be ascertained by comparing with some other instrument or a tuning fork or pipe. The next rod may be put in the same length as the last one now is, and cut down cautiously, a little bit at a time, till it produces the next note higher in the scale. In this manner proceed to the end, the rods getting shorter as you go up the scale, taking care to get the semitones in the proper places. In Fig. 1 the dashes between the rods show the



semitones if the natural scale of C is chosen. The old notation notes are given above, and the corresponding tonic sol-fa notes below.

C  $\sharp$  and F  $\sharp$  might be added, thereby giving the performer command of the keys of C, G, and D.

When learning to play on it, it is advisable to paste little labels on A (the bottom bar), with the names of the principal notes, as D, M, S, D, etc., and it will be found quite easy after a little practice to hit on any note that is wanted at once.

In order to complete the instrument, it will be necessary to give it a firm foundation; this may be done in two ways. If not intended to be shifted about much, four legs about 2" long may be screwed on, a few inches from each end, as shown in Fig. 1.

The bevel of the bar will give sufficient slope to make it firm on its legs. If intended to be carried about or packed away, it would be better to provide two feet about 1' 2"  $\times$  2"  $\times$  1 $\frac{1}{4}$ ". If these are fitted neatly, with a dovetail check, as shown in Fig. 4, they will slip off and on, and give a firm support to the instrument on a table.

It must be remembered that the length of the rods alone affects the pitch; and after considerable experiment I have found that  $\frac{1}{2}$ " is the diameter which gives the best results, and that the most suitable material is straight-grained yellow pine. White pine might be as good, but would perhaps be more difficult to procure free from knots.

As the music is of a flowing character, such tunes as "Home, sweet home," and "The last rose of summer" are the most suitable, and when accompanied by the piano the effect is extremely good and pleasing.

I have heard duets played on a pair of such instruments with great effect. The one which takes the second part has longer rods and feet, like Fig. 4, and stands on the ground while in use. The bottom bar, or feet, should get a coat or two of spirit or copal varnish; but the rods must on no account be varnished or polished, and must be kept scrupulously free from grease. The more they are played the more readily will the sound respond to the touch, as the pores

of the wood will get filled up with resin, and less will be required on the hands. Sometimes one of the rods, when put in and cut to the proper pitch, will give a false note. The only remedy is to take it out and put in another.

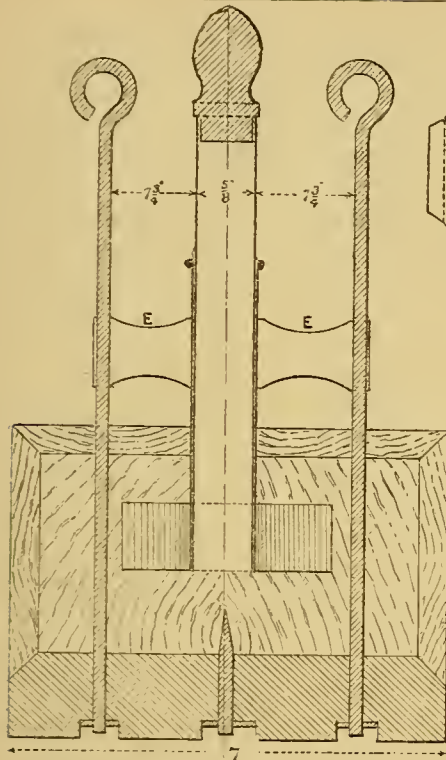
In playing quick tunes, a little study is necessary to arrange the hands for the notes so as to avoid, as much as possible, awkward crossings. A note may be sustained as long as desired, and quite equal throughout, by beginning with one hand at the top of the rod as the other approaches the bottom, and an effective crescendo is obtained by increasing the pressure on the rod.

## AN APPLE CORER, WITH CUTTING-BOARD AND GUIDE ATTACHMENTS.

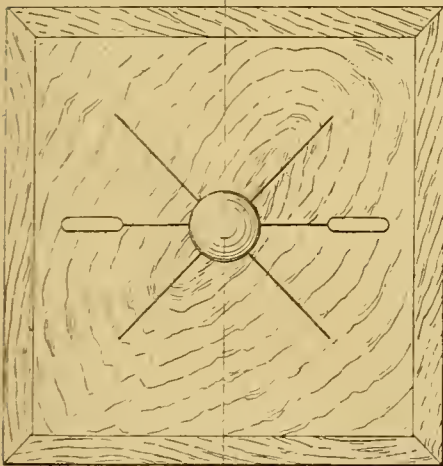
By H. J. W.



AN apple corer is such a useful adjunct to the kitchen, that I do not think the one I propose to describe will be without culinary value. I designed one a short time since, but it was found objectionable by some of our more refined "hired helps," as the apple had to be held in the hand while undergoing the process of being quartered and cored. For these over-nice people I altered it until it resembled the enclosed sketch, which will, I think, explain my meaning. It does away entirely with holding the apple in the hand. The corer is made exactly the same as the one described in my former article on the subject (Part 20, page 359), with the exception of two guides soldered securely to the cylindrical tube of the slicer, to keep it in its proper position (see pattern for same). These must fit accurately around the wire supports, so that they will not work too easily, but, on the other hand, they must not be too tight. Top and bottom edges are folded or pleated, to prevent the operator cutting his or her hands. The size of cutting-board is 7 by 7 by 1 $\frac{1}{2}$  inches, and is made of some hard wood, the edges being bevelled  $\frac{1}{2}$  inch, and a hole bored for the spike, which is a piece of pointed wire, and should not project more than  $\frac{3}{8}$  inch. Two holes are also required

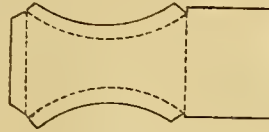


SECTIONAL ELEVATION.



PLAN

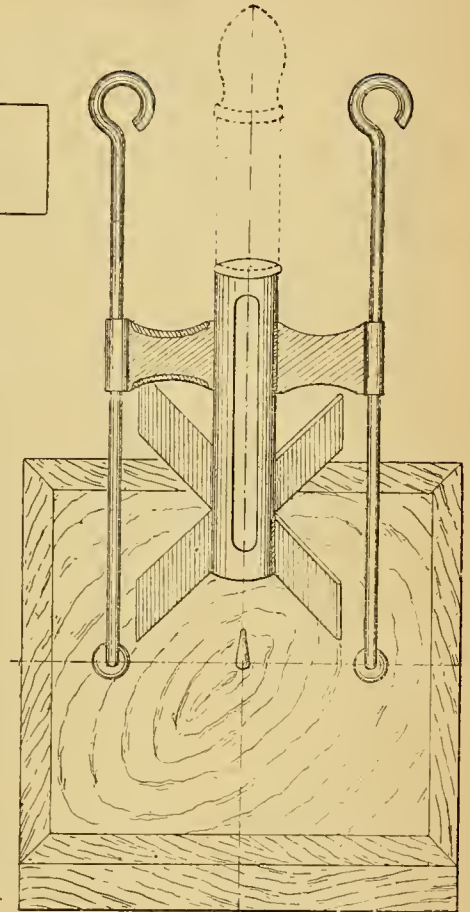
for wire supports; these should be countersunk at bottom, so that when washers or burrs are soldered to supports and spike, they will not interfere with its standing evenly (see sectional elevation). There are also burrs soldered on the top edge of the cutting-board, to give it a finished appearance, and the wire used for both



GUIDES.



ELEVATION OF CORER.



SIDE ELEVATION.

supports and spike should not be less than Nos. 6 or 8, and should be tinned, to prevent it from being rusted by the acid contained in the apples.

THE CHOICE OF A LENS.—If only one lens can be afforded, then a rapid rectilinear of equivalent focus,  $1\frac{1}{4}$  or  $1\frac{1}{2}$  times the base line of the plate, should be chosen. If funds permit of more being purchased, the writer advises the following series:—(a) A wide-angle rectilinear, focal length equal to  $\frac{5}{8}$  of the base line; (b) a portable symmetrical or similar lens, of focal length about once the base line; (c) a rapid rectilinear as above; and (d) a long-focus single lens, the equivalent focus of which should be  $2\frac{1}{4}$  times the base line.—*The Amateur Photographer.*

## HOW I MADE AN ELECTRICAL MACHINE.

By T. W. W. R.

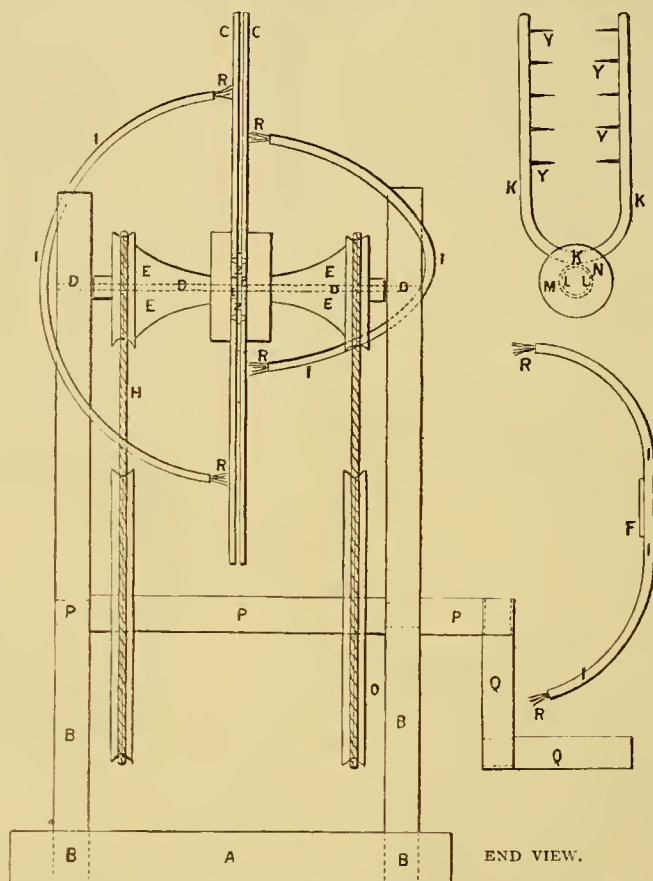
**T**AKE a piece of deal 2 feet long, 10 inches broad, and 1 inch thick for the base, A, plane up and round off

corners, then get two pieces  $15\frac{1}{4}$  inches long, 2 inches broad, and  $\frac{3}{4}$  inch thick for the uprights, B; find the middle of the base, and let them in across the narrow part,  $6\frac{3}{4}$  inches apart, leaving a shoulder to prevent them going in too far; round off the tops, and remove all corners or angles. Then measure 2 inches from the top, and insert a piece of steel wire  $\frac{1}{4}$  inch in diameter; a very thick knitting needle will do. Go to the glazier's and get two pieces of ordinary window glass, c c, as flat as possible cut in

circle 12 inches in diameter; in the centre of each have a hole drilled  $\frac{1}{2}$  inch in diameter,  $\frac{1}{2}$  inch from this hole (on each side) have two  $\frac{1}{4}$ -inch holes drilled in each glass, countersunk (the  $\frac{1}{4}$ -inch holes only) to take screws; this is to enable the glasses to be screwed on to the bosses marked E. Next get a turner (or, if you have a lathe, turn them yourself), and get two bosses, E, turned with a hole through each to take the steel wire before mentioned—the wheel, with a groove in it to take the driving cord  $2\frac{1}{2}$  inches in

diameter, and the shoulder for the glass to fit on the same size as wheel, leaving a small ridge or circle of wood at the end to fit into the  $\frac{1}{2}$ -inch hole in the glass, as before mentioned. Then screw the glasses on—one to each boss—with two screws through the  $\frac{1}{4}$ -inch countersunk holes. You will find that by these means the glasses will be firmly fixed on the bosses, which is most essential,

and requires careful workmanship. When at the turner's get two wheels, o o,  $6\frac{1}{2}$  inches in diameter, for the multiplying wheels, with a hole in each 1 inch square, to take the axle. The axle for these two wheels must be in an exact line with the axle of the bosses and centre  $7\frac{1}{4}$  inches below it, and the wheels must be immediately below the wheels on the bosses. The length of the axle, P, should be 10 inches, and should project one end, as shown in illustration, to enable a handle to be fixed to it to drive the machine by. The



handle is left to the maker, but an idea of the size can be gleaned from the illustration, the actual size being a matter of fancy. Black-lead the parts of the axle where they revolve in the uprights, and remove all superfluous lead.

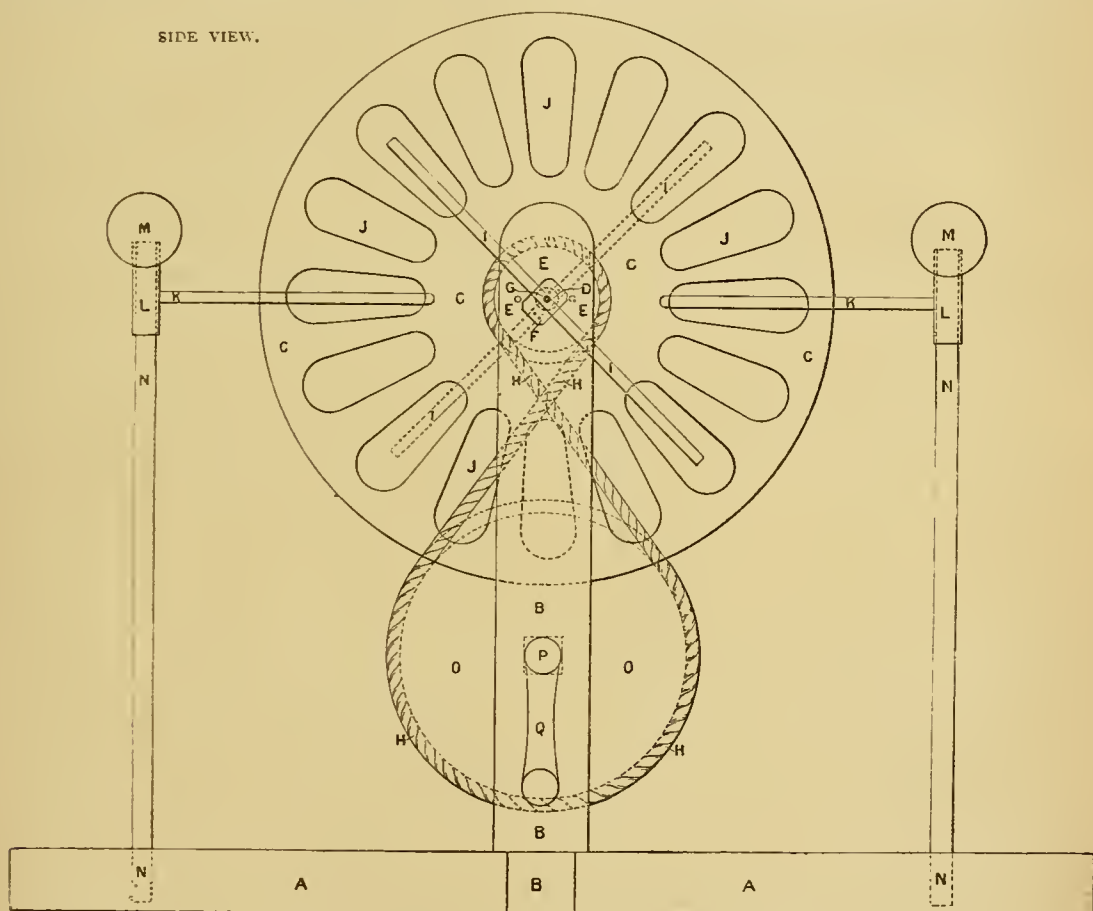
Before fixing the glasses on the bosses they must have sixteen sectors of tinfoil, J, stuck on each with shellac varnish, 3 inches long, and of the pattern shown in the illustration, J. These must be fixed on the same side of the glasses as the bosses are fixed, at equal distances, like the



figures on a clock face. A good way of getting them at equal distances is to rule up a disc of paper, and put the glass over it; the position of the tinfoil sectors can then easily be seen. The glasses must then be gently warmed (not too hot), and varnished with shellac varnish all over on both sides, with the exception of the tinfoil sectors: but these should be carefully

cient length to make two endless bands to connect the multiplying wheels with the bosses. Put the machine on your bench, endways to yourself, so that you only see the edges of the glasses; the handle must then be on the right-hand side as you look at it. Fix the first band round the upper and lower wheels on the right-hand side (nearest the handle), and tighten it so that on

SIDE VIEW.



varnished round the extreme edges, to prevent the brushes, presently mentioned, from rubbing the tinfoil off. Put the two glasses (previously fixed to the bosses) on the steel axle face to face as close as possible, with the tinfoil on the side farthest from the centre (*e.g.*, on the sides nearest the uprights), placing a small disc of ebonite or vulcanite between the two bosses to prevent them rubbing against each other when revolved. Take two pieces of tape or leather, *ii*, of a suffi-

turning the handle, on which the multiplying wheels are fixed, the glass on the upper wheel and the boss will turn easily. The two glasses must revolve in opposite directions as close to each other as possible without touching; this is the reason the glasses must be cut out of good (*i.e.*, perfectly flat) glass. To effect this, the second band must be twisted once after it is placed over the upper wheel, and before it is placed on the lower wheel on the left-hand side. If the

instructions have been carefully followed, on turning the handle the bosses with the glass fixed thereon will revolve rapidly in *opposite* directions. The base and uprights should then be stained and varnished to taste.

You will then want some brass rod for the conductors,  $\kappa$   $\kappa$ , and arms,  $\iota$ ,  $\iota$ , about  $\frac{1}{4}$  inch thick. I used some old brass stair-rods.

Take a piece of the brass rod, about 12 inches long, and bend it in the shape of the letter U, the points to be about  $2\frac{1}{2}$  inches apart (see diagram,  $\kappa$ ). Drill five holes on the inside of each arm of the U-shaped pieces about  $\frac{1}{2}$  inch apart, and solder in these the pointed ends of blanket pins  $\frac{1}{2}$  inch long.

At right angles to the back of the conductors,  $\kappa$ , solder on a piece of brass tube about 2 inches long, and just thick enough to fit tight on to a piece of glass rod  $\frac{1}{2}$  inch thick.

Turn the machine sideways to yourself, and measure from the centre  $8\frac{1}{4}$  inches right and left, and in the points found bore a hole nearly through the base to take a piece of glass rod, which must be varnished in a similar manner to the glass discs. The glass rods,  $\nu$ , should be about  $14\frac{3}{4}$  inches long, after allowing an inch to fix in base. Fix one of these each end, and on the top put the conductors,  $\kappa$  (see illustration), in a line with the axle of the glasses. To give it a finished appearance, take two small wooden balls (similar to those sold at four a penny); bore a hole in them half-way through, and fix them, one on each conductor (on the brass tube part), at the top, and cover them with tinfoil.

All that now remains to finish the machine is to take two pieces of the brass rod,  $10\frac{1}{2}$  inches long, and bend them in the shape shown in the illustration marked  $\iota$ ,  $\iota$ . In the middle of each solder a small piece of sheet brass about 1 inch long and  $\frac{3}{4}$  inch broad; this is to enable them to be screwed to the uprights, as shown in illustration. I used for the purpose of screws, to fix these rods to the uprights, four small steel eyelets (two in each), which served as thumb-screws, and enabled the arms to be easily removed as often as necessary for the purpose of inserting new brushes. In both ends of each

arm drill a small hole about  $\frac{1}{8}$  inch in diameter (in the same position as the lead in a pencil) and about  $\frac{1}{2}$  inch deep. Next get a reel of very fine brass wire (brass wire is necessary because of the spring in it); it can be bought at gold lace manufacturers, and is cheap.

This must be made into fine brushes, about  $1\frac{1}{2}$  inches long, with about twelve hairs in each, and a brush must be inserted in each of the  $\frac{1}{8}$ -inch holes previously mentioned, and wedged in with a piece of "match" stick. By so doing, they can be easily removed when worn out (which, however, is not often), although sometimes, when first adjusting the machine, they have to be cut to get the exact length, and in cutting them an accidental cut renders them useless, and they have to be replaced.

These arms, with the brushes fixed, are to be fastened on the uprights, one on each side, at right angles to each other, the one on the side next the handle sloping from left (at the top) to right (at the bottom), and the other in exactly the opposite direction (see illustration). Great care must be shown in fixing these arms, as the working of the whole machine depends almost entirely on the adjustment of the small brushes. They should be slightly bent in the direction the glass on each side revolves, to avoid rubbing the extreme edges of the tinfoils, they being adjusted so as to brush lightly in the centre of each sector of tinfoil as they revolve.

The brushes must be of such a length to prevent the actual points from being at right angles to the glasses (*i.e.*, a little too long).

Everything being now finished, dust the machine carefully, and warm it slightly, to remove all damp from new wood, etc. It is not necessary to always warm it before using, like the old plate machine; but if all else fails to make it start, the warmth helps it, especially after the machine has been put away for some time.

If all is well, on turning the handle sparks will be seen about the brushes, and leaping across the spaces between the tinfoils, and a crackling noise will be heard, and the electricity will collect on the conductors, from whence it can be worked into a Leyden jar, or according to fancy.

## A SIMPLE STORAGE BATTERY.

ET two half-round porous cups and a round glass jar large enough for the two porous cups to stand in upright. Get two plates of sheet lead  $\frac{1}{8}$  inch thick, wide enough to fit the half-round side of the porous cups, and deep enough to come an inch or so above the top edge of the cups and jar. Solder a stout copper wire or a screw post to each lead plate at the top. Place the lead plates in the cups, and fill the cups nearly full with a paste made of red lead mixed with a solution of sulphate of soda thin enough to run like a cement. The glass jar containing the two cups should be filled to within  $\frac{1}{2}$  inch of top of cups with sulphuric acid and water, about one part of acid to eight parts of water. One plate should be marked x, so that, in charging, the currents will be correctly connected. This may be charged by attaching to a series of a dozen sulphate of copper cells for twenty-four hours, or from a dynamo. It should always be charged in same direction, and it will improve by repeated chargings. A wooden cover may be fitted to the glass jar, and evaporation of the fluid should be replenished by adding water. Two or more cells of this battery will work small motors, lamps, and induction coils, and if thoroughly charged will retain a large volume of electricity for considerable time. After once being well charged, four to six cells of sulphate of copper battery will recharge it.—*Journal of the Telegraph.*

## EIKONOGEN DEVELOPER FOR TRAVELLING.—

Distilled water which has been  
boiled and allowed to cool .. 100 parts  
Sulphate of soda... .. 40 „

Dissolve and add :

Crystallized eikonogen .. .. 10 „  
Caustic potash .. .. 10 „

Cork well. For use, dilute with from three to ten times its volume of water. At the Photographic Society of Great Britain, Mr. Warnerke strongly recommended this for short exposures and dull days.

## HOW TO MAKE A GYROSCOPE.

By ELECTRON.

HE gyroscope is the subject of a problem the solution of which is still to seek. It has been termed the paradox of mechanics, for though it depends on gravitation, yet gravitation appears indifferent to it. It exemplifies very clearly the persistence with which a body undergoing a movement of rotation maintains itself in the plane of rotation in spite of gravitation. It also shows the combined action of two forces tending to produce rotation round two separate axes which are situated in the same plane. It was invented by M. Foucault to show the rotation of the earth on its axis. It consists of a heavy metallic disc mounted on a spindle. The ends of the spindle are drilled, and rest on two pivots fixed in opposite sides of a ring; the pivots are made so that the disc revolves with the smallest possible amount of friction. Fig. 1 shows the instrument thus mounted; Fig. 2 shows it with a second ring outside, in which manner it is sometimes made.

Some very curious motions are produced by rotating the disc: if the ring (Fig. 1) be suspended by a cord, and the disc is rotated, while it is rotating, the ring, instead of hanging down, will fix itself at right angles to the cord. If the disc is rotated, and the head of one of the screws is fixed in a small hole on the top of a suitable stand, the ring will revolve round at right angles to the stand. If the disc be rotated, and the notch in the head of one of the screws be set on a cord stretched tight, the instrument will travel along the cord.

An American scientist has applied electricity for rotating the disc, instead of the cord which is generally used.

This instrument, if purchased, is very expensive. In the following article I propose to describe how one may be constructed at a very small cost. The drawings are full size, but the instrument may be made larger if preferred.

Turn a recess in a piece of wood the size and thickness of the disc, nail over this a piece of board, with two holes in it, and run it full of



melted lead; when cold, trim off, and bed it into a recess, turned in a piece of wood screwed on face-plate of lathe, turn the face, and drill a  $\frac{1}{4}$ -inch hole in centre (the portion between centre boss and rim is turned thinner); take out and reverse, and turn the other side in the same manner. Then prepare and turn a spindle of iron,  $\frac{1}{4}$  inch diameter, in the centre, and rather smaller at each end. The disc must now be fixed on spindle, and keyed fast in the centre. Then turn the edge of disc, making it round, and if not exactly true, take a little more off. The ends of spindle must be squared, and a  $\frac{1}{16}$ -inch hole drilled in each end; also drill a  $\frac{1}{16}$ -inch hole in

spindle, through which the end of cord is put for rotating disc.

Next turn a circular groove in a piece of wood the size of smaller ring,  $\frac{1}{2}$  inch deep and  $\frac{1}{4}$  inch wide; also turn a similar groove in another piece of wood the size of larger ring, and run into these grooves one part of lead, and two parts of tin, melted together. When cold, bed the rings into a piece of wood on face-plate of lathe, and turn the inside; then fix on a piece of wood turned to fit, and turn the outside and edges of rings, making them  $\frac{3}{8}$  inch wide, and rounding them outside. Then divide the outside of smaller ring into four equal spaces, and fix in

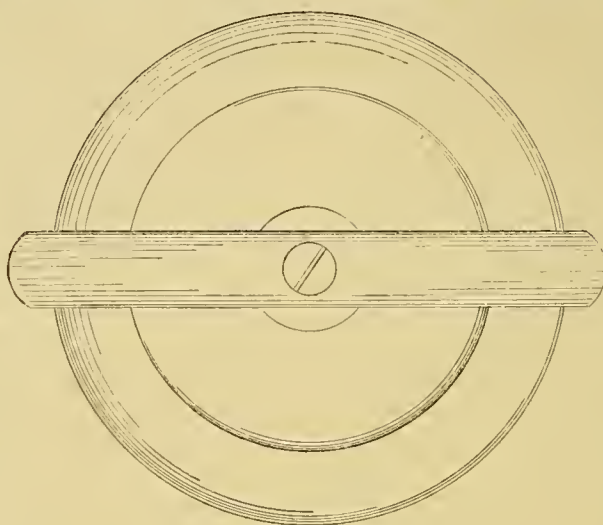


FIG. 1.—GYROSCOPE WITH ONE RING.

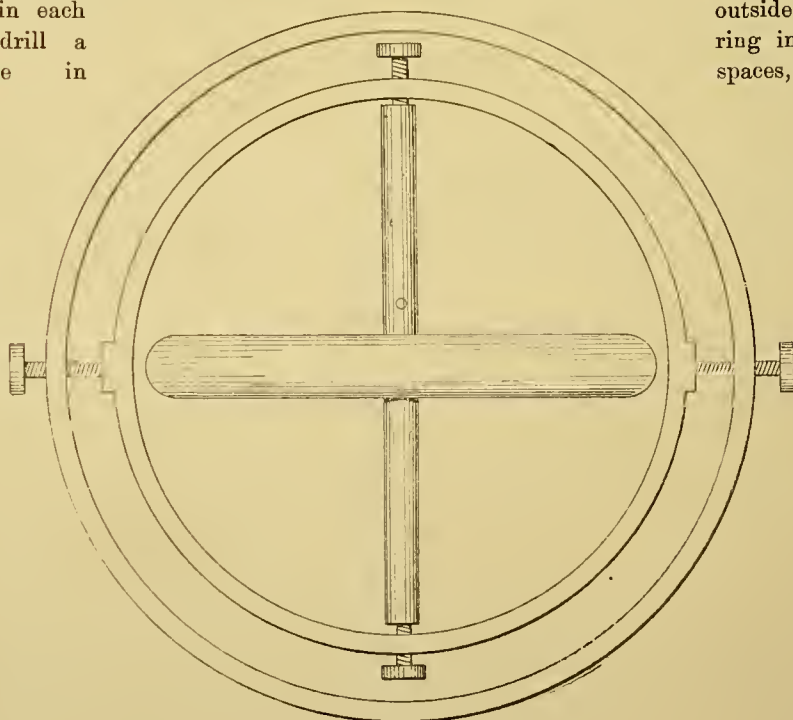


FIG. 2.—GYROSCOPE WITH TWO RINGS.

two opposite sides of ring a screw with conical point, and on the other two sides solder a piece of brass  $\frac{1}{4}$  inch square, and  $\frac{1}{8}$  inch thick, and drill in each a hole  $\frac{1}{16}$  inch diameter; also divide the outside of large ring into four equal spaces, and fix on two opposite sides a screw with conical point, and drill and tap one of the remaining marks so that it can be fixed on a lever or stand, if required.

Now fix the spindle in the smaller ring by the two screws, making it an easy fit, but without any shake. To rotate the disc, get a piece of thin cord, half a yard in length, pass the end through the hole in spindle, and coil the cord on spindle. When the cord is pulled quickly off the spindle, the disc will revolve for a considerable time, and the experiments already named can be performed. The smaller ring can be fixed in the large ring by the two screws, the points of which are fixed in the holes in the two pieces of brass. Sometimes the outer ring is mounted on the point of a stand, or it may be fixed to a balanced lever, which is set on the point of the stand, or it may be suspended by a cord.

**REPAIRING TERRA-COTTA.**—In the handling and re-handling of terra-cotta, of all kinds, it is liable to be chipped or broken, especially on the corners where it is to be joined to some other piece of the architectural design. When this happens, it is best to examine the broken part, and if it has a slant outward or inward, take a sharp chisel and light hammer and make saw-teeth indentures in the sharp part of the break, and then when it is in position point up the place with a cement composed as follows: Mix 20 parts clean river sand, 2 litharge, and 1 of quick-lime, into a thin putty with linseed oil; if for red terra-cotta, colour to the desired shade with Venetian red; if buff, with yellow ochre; if brown, with Spanish brown. The cement should be made all at one time, and the pointing-up should also be so done as to avoid a variety of shades. When this kind of cement is applied to mend broken pieces of terra-cotta, or to mend broken pieces of stone, as platforms or exterior or interior steps, it acquires, after some time, a stony hardness.—*The Brickmaker.*

## NOTES ON NOVELTIES.

By THE EDITOR.



**RIZALINE CARDS.**—Messrs. Harger Bros., Settle, Yorkshire, the well-known dealers in fretwork materials, send specimens of Rizaline Cards, a production that is quite new to me, and is probably a novelty to most, if not all, readers of *AMATEUR WORK*, since Messrs. Harger Bros. say of these cards: "Rizaline Cards are a perfectly new departure from any of our other cards, and also from anything hitherto produced in the card way." Judged by the specimens before me, they are the most artistic novelty in cards that I have yet seen, and coming as they do at a most appropriate season, they should have a very large sale. Although they are termed "cards," they are not to be confounded with the ordinary cardboard article, since their composition is entirely different. Portions of the cards are as clear and transparent as glass, while other parts have a surface closely resembling Chinese rice paper, and having that delicate, rich, soft touch that artists prize so much, and which is the especial charm in painting on rice paper. I find also that they offer a very good surface for writing upon; and those who are not great at painting, may have a strikingly novel and artistic Christmas card by simply writing their good wishes across one of the Rizaline cards. The price is very moderate. Nos. 91 to 96, inclusive, and Nos. 914 to 919, inclusive, 1s. 4d. per doz. If less than 1 doz., 2d. each. Nos. 100 to 105, and 930 to 969, inclusive, 1s. 9d. per doz. If less than 1 doz., 2½d. each. Nos. 1,000 to 1,005, inclusive, 2s. 3d. per doz. If less than 1 doz., 3d. each. Postage paid on orders of 5s. and upwards.

Messrs. Harger Bros. also bring under my notice a preparation known as *Ivoryne*, which, as suggested by the name, is an excellent imitation of ivory, including the grain. It is prepared in thin sheets, 20 inches by 15 inches, suitable for fine fretwork or hand-painting, the price of the sheet being 2s. 6d.; or any size will be cut at the rate of 2s. per square foot. It is a most useful material for many kinds of artistic work; and it occurs to me that for church decoration at Christmas, letters or designs cut in this material would have a very rich effect, and at the same time would find a new departure for fretworkers.

**Rust Preventer.**—Mr. T. Birtwistle, 42, *Belvedere Road, Burnley*, sends a sample of Rust Preventer, a pale straw-coloured liquid, for application to any bright metal work which it is desired to protect from rust. It is claimed that any article, when coated with Rust Preventer, may be exposed to rain and damp without tarnishing; and the test to which I put the preparation certainly tends to confirm the claim. I took a piece of broken saw-blade, and coated one side of it with Rust Preventer. I then dipped the blade in water, and left it exposed to the weather for the space of a week. Upon examination I found that the unprotected side was coated with rust, while that portion to which the Rust Preventer had been applied remained bright. Bicyclists would no doubt find this of great advantage in protecting the bright parts of their machines from rust.

*Improved Candle Holders for Christmas Trees.*—As the season is fast approaching when such things will be in request, I shall be doing good service to householders generally in calling attention to an improved candle holder, invented and patented by Mr. Robert Thomas, of *Bryn Offa, Holywell, North Wales*. The old form of candle

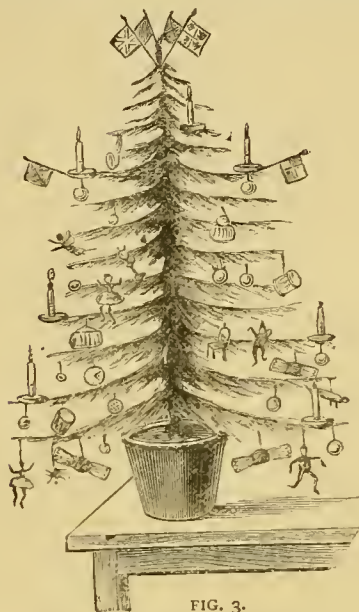


FIG. 3.

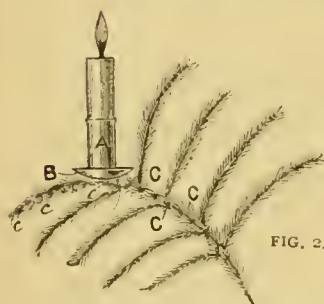


FIG. 2.

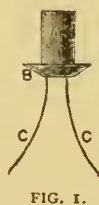


FIG. 1.

holder for Christmas illuminations was sadly in need of improvement, as numerous spoiled carpets can testify. Mr. Thomas' invention consists of an ordinary candle holder, with a carved base to catch any grease dropping from the candle or taper, and having one or two flexible wires attached that can be twisted or coiled round the object to which it is desired to secure the holder. Fig. 1 is an illustration of the holder, A being the tube in which the candle is fixed; B, the curved base for intercepting grease; and C, the flexible wires. Fig. 2 shows the holder attached to the branch of a Christmas tree by winding or twisting the wires round the branches, and Fig. 3 represents the tree with the holders in position. The moderate price at which these holders are produced and sold, and the ease with which they can be attached, will no doubt cause the invention to become very popular.

*Exercises in Woodworking, with a Short Treatise on Wood* (W. Allen & Co., Caxton House, Paternoster Square. Price 5s.)—This work has been specially written for manual training classes in schools and colleges, but is equally valuable for self-instruction at home; in fact, an amateur, by following patiently the clear and concise instructions, given in a carefully graduated series of lessons, might easily become a proficient wood-worker. The first part of the book treats of the structure, properties, and kinds of wood: its manufactures and economic relations to other substances; parasitic plants and insects; and means of preserving wood. The second part contains a series of lessons, carefully and fully illustrated. Exercises 1 to 8 introduce the chief wood-working tools, and methods of marking. Following Exercise 8 are directions for sharpening tools. Exercises 9 to 20 give instructions for marking out and making simple joints. Exercises 21 to 27 instruct in the methods employed in uniting several pieces to make a complete structure. Exercises 28 to 35 give the details of ordinary house-carpentry, from which the student may obtain particulars for the construction of models, and the apprentice the actual building of the various parts making up a wooden dwelling. Exercise 36 shows the use of the frame saw, and methods of beuding wood. Exercise 37 gives an example of pattern-work, and illustrates the manner of uniting pieces for economy of labour. Exercise 38 instructs in shaping by the use of templates. Exercise 39 treats of veneering, followed by directions for painting and polishing.

In the majority of cases the instructions are given on one page, while the opposite page is devoted to illustrations of the work in its different stages. The author has an absolute command of his subject, and the whole work bears evidence of a thorough knowledge of the difficulties that a learner has to contend with. I can with great confidence recommend the book to amateurs, apprentices, and students as a most valuable aid to a knowledge of wood-working.

*Brazz-o-line.*—Mr. T. Birtwistle, 42, *Belvedere Road, Burnley*, also sends a sample of a liquid preparation to which he has given the peculiar, if not euphonious, title of "Brazz-o-line." It is a lacquer which can be applied without heat to new goods, or for relacquering brass articles that have become soiled. The directions for use are:—The article to be relacquered must be made perfectly clean and bright with some cleaning paste, and rubbed until perfectly free from grease. Then apply the lacquer with a camel-hair brush as evenly as possible. It must be laid upon the article in one direction, and on no account must it be rubbed backward and forward.

*Court Mourning Stationery.*—Messrs. John Dickinson and Co., Limited, *Apsley Mill, Hemel Hempstead*, call my attention to their new mourning stationery. Instead of the hideous black border that has hitherto indicated the depth of our sorrow by its vulgar variations of width, the new paper has the top left-hand corner black. This is a decided and much needed improvement, and I am glad to think that the old black-bordered paper, for which I always had a special dislike, must give way to the new Court Mourning Stationery.



## AMATEURS IN COUNCIL.

For "Instructions to Contributors and Correspondents," see p. 46 of this Vol., or Part 13 (New Series), p. 46.

### Casts of Small Insects.

"MANCHESTER" asks:—"How can I obtain a cast in solid metal of a beetle or similar object? Such casts, if clean and well finished, would be useful for many decorative purposes." Make the moulds of finely-ground plumbago 3 parts, potter's clay 1 part. Mix thoroughly with water, and thin enough to run. Make a small paper box open on one side, and impale the insect on large pins passed through the box and into the insect to hold it in position, and for ventilation. Let some of the pins touch the legs also for ventilation. When the insect is properly adjusted in the box, and a large pin or pouring gate is made to touch the body, and held in place by passing through the box, pour the thin mixture slowly into the box until it is filled, being careful to clear away any air bubbles that might hang in contact with the insect. Set the mould in a warm place to dry. As soon as it is set, or hard enough to handle, pull out the pins and gate, and take off the paper box, and place in a warm place to thoroughly dry. Then place it in a small iron box, so as not to expose the mould to sudden heat, and slowly heat to a full red, and while at a red heat blow air through the mould to burn any carbon that may remain. See that the vent holes and gate are all clear, when the mould will be ready for pouring in the metal. Have the mould quite hot when you pour, to insure the metal filling every part. Soak the mould in water for a few hours, when it can be cut away with a knife.

### Net Making.

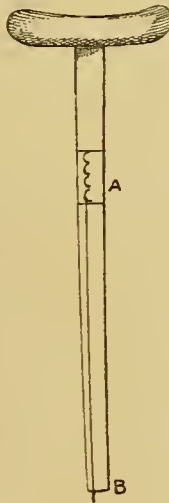
"E. D. C." is making a net, 43 feet long by 5 feet broad, of string, like pattern enclosed, which he intends to soak, when finished, in Stockholm tar. How much ought he to allow on the whole net for shrinking? [I sent your query to a boat-owner and fisherman whose acquaintance I made during my holidays this summer. As he has spent the whole of a long life amongst fishermen,

you may take it that what he does not know about such matters is not worth knowing. His reply is: "If you tar the net, it will shrink about 6 feet, but the fishermen here usually preserve their nets by soaking them in bark liquor. In that case your net would shrink about 3 feet. If you decide to tar the net, the tar will have to be watched very carefully, so that it may not boil over; for if it did, the consequences would be very serious."—Eo.]

### Wanted, Suggestions for a Safety Crutch.

CRUTCH (*Glasgow*) writes:—I am one of those unfortunates who have to use a crutch in walking, and I have tried all sorts of plans to prevent it from slipping on the frosty roads, but as yet I have not come across the right notion. Perhaps some of your, "Amateurs in Council" may be able to make a suggestion? The following is the most feasible, if the fittings could be so arranged as to be properly put together. I think if someone could suggest how to fit the above together, so

that a simple turn of the part, A, where the hand grips, would either propel or withdraw the pike, B, at the bottom, it would meet my difficulty.



### Glue for Archery Bows.

ROBIN HOON—I cannot claim any acquaintance with archery manufacture, but I have been informed that glue is used to fix the spliced cane handles to cricket bats, and I know what great strains glue bears in musical instruments, such as pianos. The only other substance, I think, comparable with a good sample of glue, such as Cox's "Long Scotch," is the newly introduced fish glue. Ordinary glue is sometimes used with some dilute acid as solvent. "Giant cement," "coaguline," and the other similar cements are of the same nature. They all have the same fault—a very little alkali in water serves to

dissolve them, and to break the joint in consequence. An insoluble glue is said to be made by using a solution of bichromate of potash as solvent; such a glue on exposure to light becomes insoluble, but I cannot say how the potash-salt would affect its adhesiveness, or whether in the absence of light the bichromate of potash would have any effect.

I should try ordinary glue of the best quality; if that fails, try the new fish-glue.

Perhaps an easy test for the best quality glue may be useful. Good glue should have neither taste nor smell; the less antiseptic used in the manufacture the better. It should absorb water very slowly, and though absorbing much should not be dissolved by cold water. Good glue should need heat to develop any adhesive property it may possess.—B. A. BAXTER.

### Model Boat Building.

"H. B." (*Jarrow-on-Tyne*) writes:—I would like to offer a few remarks in the way of friendly criticism on the article by "Pakeha" in this month's AMATEUR WORK; not in any captious spirit, but merely that beginners in the fascinating art of model yacht building and sailing may not be led into a weak style of working for the sake of speed in getting over the work; for I hold that whatever is worth doing is worth doing well. Especially is this applicable to model yacht building. To begin at the foundation, or the keel: according to "P." it is to be got out of a single piece of wood—keel, stem, and sternpost all in one, in which case the stem and sternpost would be cross-way of the grain, which might do for a model to go under a glass case, but a very defective plan for a sailing model; for it is well known there is not a quarter the strength in cross-grain that there is in long grain. They should be three separate pieces halved, and screwed together. Then for the ribs: he does not say which way he intends the grain to run in them, whether from side to side or up and down. But whichever way it runs, if they are got out all in a piece, as seems to be advocated by "P.," they are bound to be a source of weakness, for if the grain runs from side to side, they will be cross-grained at the top; if the other way, they will be cross at the bottom;

they should be in two pieces. Then, again, contributors should be as correct and precise as possible in the terms used. For instance, what "P." calls the stern is properly called the counter. The whole of the after-part of the ship is the stern, but the aftermost part of the stern, that part above water, is the counter, and which he advised to be got out of a solid piece of oak, which would make the stern very heavy. If he had said yellow pine, it would not have been so bad; but it is much the best to let the planking run quite to the end, which can be done with a little patience and perseverance. Again, "P." says: "Fasten on the garboard strake; that is, the top plank of all." Now, anyone that knows anything of boat building, knows that the garboard strake is the *bottom* one, and that is the one that should be put on first; then work upwards to the top, not the top one on first; then the one to form the water-line. You cannot put a plank on a ship or boat to run fair with the water-line. It is useless trying it. They will run up forward and aft. Then as regards the wood to be used for the planks. "Cut your coat according to your cloth" may be a good maxim in some things, but it scarcely applies, I think, to model yacht building. The best way to begin is to set out your plans according to some recognised rule of yacht building, either a five, ten, or fifteen tonner, as the case may be, the rule for which may be found according to the following formula, as I suppose it would be called, viz.,  $\frac{(L \times B)^2 \times B}{1730}$ , which means

add the breadth or beam to the length (on the load water-line), square the product, which multiply by the beam, and divide by 1730. I would give an example, but am afraid it would take up too much space. If you think it would be acceptable, I will give one or two another time, together with another rule of measurement, called the sail rating. But to return to "P." He says the drawings are to a scale of 3 inches to 1 foot. According to that, his model is hardly 7 inches beam. Yet he says, "Your boat being about 8 $\frac{3}{4}$  inches beam." Which does he intend it to be? But about the best wood for the planks: I certainly should not advise a beginner to use oak. He will

find it very troublesome. I would advise yellow pine for a first attempt; next to that, cedar or mahogany, which I should think might be got as cheaply as oak, by getting fretwood and cutting it up with a cutting gauge. I am afraid the Editor will think I am running this letter out to an inordinate length, or I would give directions for fitting on a hatch, or, as "P." calls it, a well. But I think the modellers will have enough to go on with at present. [We should be glad to have your directions for fitting on a hatch.—Ed.]

#### Typographic Blocks.

TYPOGRAPHICUS.—Briefly the process is as follows:—A negative is taken of the subject to be reproduced, by means of the wet collodion process, the chief point requiring attention being the production of absolutely bare glass representing the lines of the subject. Paper coated with chromated gelatine is exposed under this negative in a printing frame, and after exposure the print is taken from the frame and given a thin coating of greasy printing ink, and soaked in cold water, when it will be found that the printing ink will leave the gelatine in those parts protected from light, and only adhere to the image. The print is now placed face downwards on a sheet of zinc, and passed through a press, when the ink leaves the paper, and adheres to the zinc. The image on the zinc is then rolled up with more ink, special precautions being taken to prevent the lines of the image from being under-bitten by the etching fluid; when etched deep enough the plate is cleaned, mounted type high, and is then ready for printing from.

#### Criticism.

A CORRESPONDENT writes.—"One does not like to find fault, but I should like to know if anyone ever succeeded in making the articles described on page 363, part 20; page 397, part 21; and page 439, part 22. I do not say they are impracticable (with some modifications), but I should like to see one of each successfully executed, and, if possible, by the designers. As I have expressed my doubts as to some articles, let me assure you that I appreciate all articles by A. Martin, E. C. Roe, A. Savil, the "Lathe" articles by J. L. Dwyer, Faust's articles, and the first-rate articles on "Fitting and Erecting"

by a "Foreman Patternmaker," also anything written by "J. H." and "Organ Builder." Many others might be mentioned; but these, which are *first-rate*, I believe to be the cream." [Any gentleman who feels himself aggrieved by the above candid expression of opinion, may give vent to his feelings in these columns.—Ed.]

#### Easy Method of Winding Coils.

"T. B." says that he has been very successful in constructing the Rhomkorff Coil, described on page 214 of the last volume, and gives his method of winding the wire. He fastens one end of the wire to a nail in the wall at the end of a long garden. Stretching the wire tightly, he commences winding from the other end by turning the coil round in his hand, thus gradually approaching the end which is fastened to the wall. By this means the winding is as perfect as if done in a lathe.

#### Moulds for Terra-Cotta.

W. J. M. SMITH writes:—I am wanting to make some "terra-cotta" ornaments, such as small figures, etc., and should feel much obliged if you or any of your readers could inform me where to purchase moulds for this purpose. [Will some of my readers oblige?—Ed.]

#### BRIEF REPLIES.

TYPOGRAPHICUS.—Your request shall have my attention. Thanks for good opinion.

C. A. PHILPS.—You have had to wait longer than I expected for the promised paper, but the author has had some little difficulty in finding a suitable motor. However, the article will be in my hands very shortly, and I venture to think you will find it worth waiting for.

"FOND OF FOUNTAINS."—See reply to C. A. Philps.

"H. J. T." (*Birmingham*).—I will hear you in mind when I find a practical man whom I can trust to write upon the subject you name. Instructions upon this matter, unless thoroughly trustworthy, are apt to lead into danger.

#### LETTERS RECEIVED UP TO OCT. 12.

RETEP; H. M. B.; B. A. BAXTER; C. HARRIS; C. W. SMITHSON; BRONCHY; S. M. LLOYD; GULIEMUS; H. J. W.; D. G. K.









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